No. 10. Vol. 5.
(New Series. No. 6. Vol. I.)

SIXPENCE.
(Registered as a Newspaper.)

FRIDAY,
NOVEMBER 18, 1904.

PAGE'S WEEKLY

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UNIVERSITY OF TORON

ENGINEERING · ELECTRICITY SHIPBUILDING MINING IRON & STEEL INDUSTRIES

EDITORIAL & PUBLISHING OFFICES, CLUN HOUSE, SURREY STREET, STRAND, LONDON, W.C.

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Russia, St. Petersburg: 14, Nevsky Prospect.
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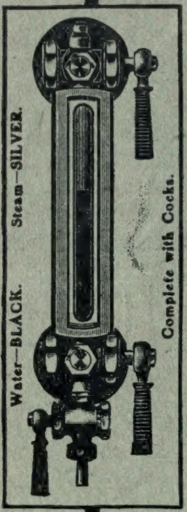
A Common Glass Tube
Water Gauge may be the Death of You
or Your Workmen. At least, it is pretty sure to injure someone, if it gets a chance.


Water—BLACK.
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Complete with Cocks.

Keep Out of Hospital

Steam—SILVER.
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Attachable Pattern.

and keep your Men out, too, by fitting up the *Only Safe Gauges* ever made. They are known as the **"Klinger" Water Gauges,** and they Won't Burst, have No Glass Tubes to break, require No Protector, and you can See the Water Level at a Glance, and at a considerable distance.

If you Value your Life, *don't work your Boiler with a common glass tube water gauge, but send for our Pamphlet* "K.A."

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Contractors to
the Admiralty.

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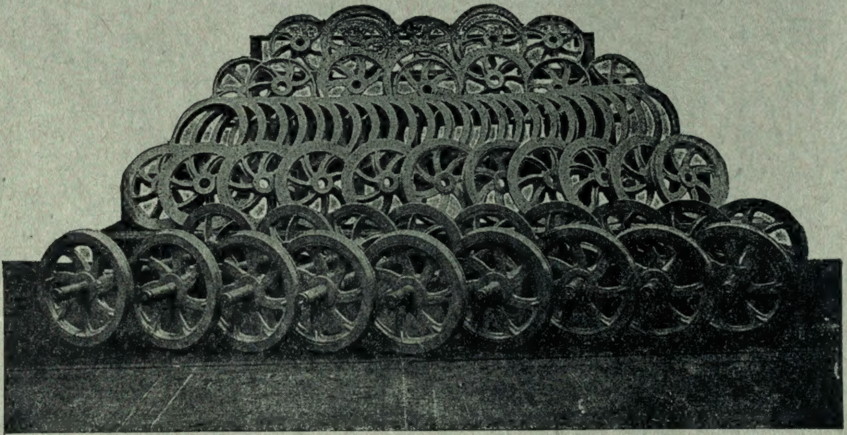

GROUP OF TRAMWAY WHEELS AND AXLES.

HADFIELD'S PATENT "ERA" MANGANESE STEEL
IS THE SUPREME MATERIAL FOR
TRAMWAY POINTS AND CROSSINGS AND CRUSHER WEARING PARTS.

PAGE'S WEEKLY Miscellaneous

Mr. G. H. HUGHES, M.I.Mech.E.,
Consulting and Organising Engineer for Water Works and Industrial Undertakings,
97, QUEEN VICTORIA ST., LONDON, E.C.
Telephone No.: 5754 Bank. Write for particulars

PAGE & ROWLINGSON,
Chartered Patent Agents.

Mr. PAGE, who is a Whitworth Exhibitioner and an Associate Member of the Institute of Civil Engineers, has had a large experience as a Practical Mechanical Engineer, and is specially qualified to deal with the most intricate mechanical problems successfully. *Write for Handbook of Information Free.*

28, NEW BRIDGE STREET, LONDON, E.C.,
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Head Office and Works, **LEEDS.**
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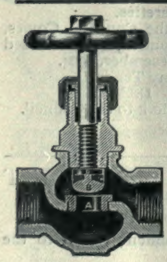

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Chips and Saw-dust FIRELIGHTERS.
GLOVER'S PATENT MACHINERY
ENORMOUS Saves 12 to 50 Men's Work. PROFITS
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THE CRYPTO ELECTRICAL Co.,
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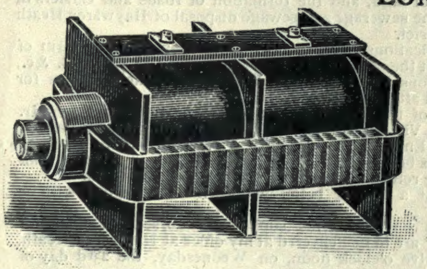

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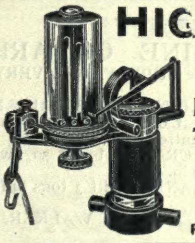

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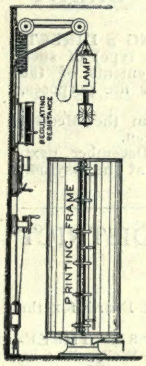

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580 MACHINES IN USE.

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39, Victoria Street, LONDON, S.W.,
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67 and 69, Chancery Lane, Telephone: 9252 Central. LONDON, W.C.

PAGE'S WEEKLY Contracts

CONTRACTS.

HAYWARDS HEATH URBAN DISTRICT COUNCIL.

SEWERAGE AND SEWAGE DISPOSAL WORKS.
TO CONTRACTORS AND OTHERS.

Notice is Hereby Given that the Urban District Council of Haywards Heath, in the county of Sussex, are prepared to receive TENDERS from persons desirous of contracting with them for the CONSTRUCTION of about SIX MILES of PIPE SEWERS, varying from 9 in. to 21 in. in diameter, together with a Steel Aqueduct over Nash Gill, and all the necessary manholes, ventilators, and sewage tanks, the laying out and fencing of land, and the formation of roads and carriers in connection with the sewerage and sewage disposal of Haywards Heath and adjoining district.

Plans and specifications of the works may be seen, and the form of Tender obtained, at the office of Mr. Baldwin Latham, M.Inst.C.E., &c., Parliament Mansions, Victoria Street, Westminster, the Engineer for the Works, on and after the 9th of November.

The quantities of the several works have been taken out by Mr. C. E. Bruges, of 1, Victoria Street, Westminster, and may be had on application to the Engineer on deposit of £10, which will be returned after a contract has been entered into to every person making a *bonâ fide* Tender, on the return of the documents entrusted to them.

In the event of a Tender being withdrawn the deposit will be forfeited.

Sealed Tenders on the forms supplied, endorsed "Tender for Sewerage Works," are to be delivered at my office at Haywards Heath, on or before Twelve o'clock noon, on Wednesday, the 23rd day of November, 1904.

The Urban District Council of Haywards Heath will not be bound to accept the lowest or any Tender.

Dated this 2nd day of November, 1904.

EDWARD WAUGH,
Clerk to the Haywards Heath Urban District Council.

THE AVONSIDE ENGINE CO. ARE

open to receive TENDERS for the SUPPLY, DELIVERY and ERECTION of :—

ONE 10-TON OVERHEAD TRAVELLING ROPE-DRIVEN CRANE ; centre to centre of rails, about 47 ft. 6 in. ; head room from top of rail, 6 ft. 6 in. ; side clearance from centre of rail, 10 in.

TWO HAND-DRIVEN WALKING JIB CRANES, to lift 30 cwt. at 7 ft. radius ; rail head to rail head, 16 ft. 3 in.

ONE HYDRAULIC JIB RIVETING CRANE, to lift 3 tons 24 ft. at a 14 ft. radius.

E. W. WALKER.

Bristol.

ESSEX COUNTY ASYLUM, BRENTWOOD.

TENDERS are invited for SUPPLYING and FIXING a DIRECT-ACTING STEAM DUPLEX PUMP (Worthington type) of such design, material, and test as shall meet the requirements of the "National Standard Underwriter" duplex pumps for fire purposes, and to have automatic auxiliary arrangement.

Specification and particulars can be obtained from the Medical Superintendent at the Asylum, where the site can be seen.

Tenders to be sent in not later than the 3rd December next, addressed to the Sub-Committee for Water Supply at the Asylum, and should be marked outside "Fire Pump."

EAST COWES URBAN DISTRICT COUNCIL, ISLE OF WIGHT.

TO PUMP MAKERS.

Subject to the sanction of the Local Government Board for the necessary loans being obtained,

The Council invite TENDERS for ONE SET of 8 in. THREE-THROW DEEP-WELL PUMPS, fitted and fixed in Well, with 6 in. Rising Main and all necessary Gear, &c., in accordance with printed forms of specification and Tender, which can be obtained from their Engineer, W. Brown, 709, High Road, Tottenham, or from Albert E. Barton, Town Hall, East Cowes, Surveyor to the Council, upon the deposit of £2 2s., which will be returned on receipt of a *bonâ fide* Tender.

The person or firm whose Tender is accepted will be required to enter into a written contract and to provide two sureties.

Sealed Tenders to be sent to the Offices of the Council, Cowes, addressed to the Clerk of the Urban District Council, and endorsed "Tender for 8 in. Three-throw Pumps," on or before the 7th December, 1904.

The Council do not bind themselves to accept any Tender.

ATHERSTONE DAMANT,
Clerk to the Council.

Council Offices, Cowes,
November 12th, 1904.

FLEETWOOD SEWAGE, 1904.

CONTRACT No. 1.

The Fleetwood Urban District Council are prepared to receive TENDERS from competent persons for the CONSTRUCTION of 1575 Lineal Yards of BRICK and CONCRETE SEWERS, varying in size from 4 ft. 6 in. by 3 ft. to 3 ft. by 2 ft.; 1377 Lineal Yards of 4 ft. Circular Brick and Concrete Sewer; of 2957 Lineal Yards of Stoneware Pipe Sewers, varying in diameter from 24 in. to 9 in.; and of 2364 Lineal Yards of Cast Iron Sea Outfall Sewers, of 36 in. and 18 in. diameter; together with Manholes, Flushing Chambers, Overflows, &c.

Plans and sections of the proposed works may be seen, and specifications and bills of quantities, together with a form of Tender, may be obtained on application to G. R. Strachan, Esq., M.Inst.C.E., 9, Victoria Street, Westminster, London, on and after Monday, the 7th inst., on payment of a deposit of Five Guineas, by cheque, which will be returned on receipt of a *bonâ fide* Tender.

Sealed Tenders, endorsed "Tenders for Sewerage Works," are to be delivered to me at my office in Fleetwood on or before 10 o'clock a.m. on Saturday, 26th inst.

The lowest or any Tender will not necessarily be accepted.

By order,
JOSEPH TILDSLEY,
Clerk and Accountant.

Town Hall, Fleetwood,
November 1st, 1904.

WEST LONDON SCHOOL DISTRICT.

The Managers are prepared to receive TENDERS for the work of LINING THIRTEEN WATER TANKS with Concrete, Brickwork, and Limmer Asphalte Company's Asphalte (the tanks being situated in the upper storeys of the schools and buildings at Ashford, Middlesex, in accordance with a specification and drawing prepared Mr. G. MIDGLEY TAYLOR, M.Inst.C.E., of 27, Great George Street, Westminster, S.W., of whom further particulars may be obtained.

The drawing may be inspected at the Schools.

Forms of Tender, with copies of the specification and general conditions, will be forwarded by the undersigned on receipt of a stamped addressed envelope, of brief size, and must be returned marked "Tender for Lining Water Tanks," sealed and addressed to the Managers, not later than 6 p.m. on Thursday, the 24th November, 1904.

The Managers do not bind themselves to accept the lowest or any Tender.

By order,
F. G. BEECHING,
Clerk to the Managers,

Ashford, Middlesex,
October 27th, 1904,

EAST COWES URBAN DISTRICT COUNCIL, ISLE OF WIGHT.

TENDERS FOR MAIN FROM WATERWORKS TO TOWER.

Subject to the sanction of the Local Government Board for the necessary loans being obtained,

The Council invite TENDERS to LAY a 6 in. CAST IRON MAIN from the Waterworks to the Water Tower and along Victoria Grove, together with valves and all necessary fittings, in accordance with the printed forms of specifications and Tender, which can be obtained from their Engineer, W. Brown, 709, High Road, Tottenham, or from Albert Barton, Town Hall, East Cowes, Surveyor to the Council, upon the deposit of £2 2s., which will be returned on receipt of a *bonâ fide* Tender.

The person or firm whose Tender is accepted will be required to enter into a written contract and to provide two sureties.

Sealed Tenders to be sent to the Office of the Council, Cowes, addressed to the Clerk to the Urban District Council, and endorsed "Tender for Water Main," on or before the 7th December, 1904.

The Council do not bind themselves to accept any Tender.

ATHERSTONE DAMANT,
Clerk to the Council.

Council Offices, Cowes,
November 12th, 1904.

EAST COWES URBAN DISTRICT COUNCIL, ISLE OF WIGHT.

TENDERS FOR ENGINE AND SUCTION GAS PLANT.

Subject to the sanction of the Local Government Board to the necessary loans being obtained,

The Council invite TENDERS for one 50-H.P. ENGINE and SUCTION GAS PLANT, fitted and fixed complete, in accordance with the printed forms of specification and Tender, which can be obtained from their Engineer, W. Brown, 709, High Road, Tottenham, or from Albert E. Barton, Town Hall, East Cowes, Surveyor to the Council, upon the deposit of £2 2s., which will be returned on receipt of a *bonâ fide* Tender.

The person or firm whose Tender is accepted will be required to enter into a written contract and provide two sureties.

Sealed Tenders to be sent to the Offices of the Council, Cowes, addressed to the Clerk to the Urban District Council, and endorsed "Tenders for Engine and Suction Gas Plant," on or before the 7th December, 1904.

The Council do not bind themselves to accept any Tender.

ATHERSTONE DAMANT,
Clerk to the Council.

Council Offices, Cowes,
November 12th, 1904.

PAGE'S WEEKLY Contracts

COUNTY BOROUGH OF CARDIFF.

TO MAKERS OF PUMPING MACHINERY, STEAM BOILERS, AND GAS ENGINES.

The Corporation of the County Borough of Cardiff hereby invite competitive **DESIGNS** and **TENDERS** (from manufacturers of repute only in the particular class of work tendered for) for the **SUPPLY, DELIVERY, and ERECTION of PUMPING MACHINERY** and **PLANT** required in connection with the proposed Western District Main Outfall Sewer as follows:—

CONTRACT No. 1.—For combined Sewage Pumping Engines and Pumps of a maximum capacity of 700,000 gallons per hour.

CONTRACT No. 2.—For the Steam Generating Plant required for Contract No. 1.

CONTRACT No. 3.—For two **Sets of Gas Engines** and **Centrifugal** Storm-water Pumps, each capable of discharging 680,000 gallons per hour.

Drawings and provisional specification may be seen and full particulars as to the contemplated works may be obtained at the office of Mr. W. HARPUR, M.Inst.C.E., the Borough Engineer, Town Hall, Cardiff, on and after Monday November 7th, and copies of the drawings and specification, with forms of Tender, will be supplied on receipt of a deposit of Five Guineas, which deposit will be returned on receipt of a *bonâ fide* Tender.

Tenders, sealed and endorsed "Tenders for Pumping Machinery," to be delivered at my office on or before Wednesday, December 21st.

The Corporation does not bind itself to accept the lowest or any Tender, and will not be liable for or defray any costs incurred in the preparation of any Designs and Tenders.

J. L. WHEATLEY,
Town Hall, Cardiff, Town Clerk.
October 31st, 1904.

SOUTH AUSTRALIAN GOVERNMENT RAILWAYS.

The AGENT-GENERAL for SOUTH AUSTRALIA is prepared to receive

TENDERS FOR THE SUPPLY AND DELIVERY of:—

One **STEAM MOTOR** and **BOGIE** for **STEAM** Motor Carriage, or Alternative Tenders for—

One **COMPLETE MOTOR COACH**, either Steam or other Motive Power.

Specification, Form of Tender, and Drawings may be seen at the undermentioned Office, and copies may be obtained at a cost of One Guinea. This amount will be repaid to unsuccessful Tenderers who have sent in *bona fide* Tenders, upon return of the documents in good condition, within one week of notice of non-acceptance of Tender.

Tenders are to be sent to the undersigned, marked "Tender for Steam Motor and Bogie, etc.," not later than One o'clock p.m., on **MONDAY**, November 28th, 1904.

The Agent-General does not bind himself to accept the lowest or any Tender.

H. ALLERDALE GRAINGER,
Agent-General for South Australia.
Threadneedle House, Bishopsgate Street Within, London, E.C.,
October 28th, 1904.

TO CIVIL ENGINEERS.

COMPETITION FOR DRAINAGE SCHEME for ROSS (HEREFORDSHIRE) URBAN DISTRICT COUNCIL.

The Council desire to provide for the **DRAINAGE** and **DISPOSAL** of the **SEWAGE** of the present Urban District, together with the area proposed to be added, and for that purpose **INVITE COMPETITIVE SCHEMES.**

Competitors to supply Plans, Sections, Specification, detailed Report and Estimate of the probable cost, which are to be delivered at the Offices of the undersigned not later than December 5th, 1904.

Premiums of £50, £25, and £10 will be paid by the Council for the Schemes which they may adjudge to be best in order of merit, and such Plans and Particulars to become the absolute property of the Council.

In the event of either Scheme being carried out, the premium will merge in the fees paid to the Engineer.

It is suggested that Competitors should in the preparation of their Schemes, have due regard to the initial cost of the Works, as well as the annual cost of maintaining and working the system.

The Council do not pledge themselves to carry out any of the proposed Schemes, but in the event of any Scheme being selected, it will be conditionally that the same be approved by the Local Government Board, and that the cost does not materially exceed the estimate submitted.

The Plans and Particulars to bear a distinctive motto, and a sealed envelope bearing the same motto and containing the name and address of the Competitor, to accompany the papers.

Any further information can be obtained upon application to the Town Surveyor, and

ERNEST R. DAVIES, Clerk.
Albion Chambers, Ross,
October 21st, 1904.

JOHANNESBURG MUNICIPALITY.

The Municipal Council of Johannesburg is prepared to receive

TENDERS FOR

TWO 35 ton ELECTRIC OVERHEAD TRAVELLING CRANES

to Specification **No.** 9 of their Consulting Engineers, Messrs. MORDEY AND DAWBARN, 82, Victoria Street, London, S.W.

Copies may be seen on and after Saturday, November 5th, at the Council Offices, Johannesburg and at the Consulting Engineers' Offices in London, and may be obtained on payment of Five Guineas, which will be returned on receipt of a *bona fide* Tender.

Tenders must be addressed to Messrs. MORDEY AND DAWBARN, 82, Victoria Street, Westminster, S.W., and received by them not later than **TUESDAY**, December 27th, 1904.

The lowest or any Tender will not necessarily be accepted, and the Council will not be responsible for any expenses incurred in Tendering.

R. FEETHAM,
Johannesburg. Town Clerk.

JOHANNESBURG MUNICIPALITY.

The Municipal Council of Johannesburg is prepared to receive

TENDERS FOR:—

TRANSFORMER PILLARS and SWITCHGEAR to Specification No. 8, of their Consulting Engineers, Messrs. MORDEY AND DAWBARN, 82, Victoria Street, London, S.W.

Copies may be seen on and after Saturday, November 5th, at the Council Offices, Johannesburg, and at the Consulting Engineers' Offices in London, and may be obtained on payment of Five Guineas, which will be returned on receipt of a *bonâ fide* Tender.

Tenders must be addressed to Messrs. MORDEY & DAWBARN, 82, Victoria Street, Westminster, S.W., and received by them not later than **TUESDAY**, December 27th, 1904.

The lowest or any Tender will not necessarily be accepted, and the Council will not be responsible for any expenses incurred in Tendering.

R. FEETHAM,
Johannesburg. Town Clerk.

APPOINTMENTS OPEN.

EGYPTIAN GOVERNMENT.

PUBLIC WORKS DEPARTMENT.

APPLICATIONS ARE INVITED FOR THE POST of INSPECTOR of IRRIGATION in the above service,

for a period of five years, at an annual salary of One Thousand Egyptian Pounds, and a gratuity of one year's salary at the end of this period.

Applicants must be of English birth, and their age must not exceed 45 years. They must have had at least 15 years' service in the Irrigation Branch of the Indian Public Works Department.

Applications, which should contain a full statement of services, with certificates or references, should be addressed to—

THE UNDER SECRETARY OF STATE.
Public Works Department, Cairo, Egypt.

CITY OF SHEFFIELD. — DERWENT VALLEY WATER ACT, 1899.

The Corporation of Sheffield invite **APPLICATIONS** from competent engineers for the **APPOINTMENT** of **RESIDENT ENGINEER** in the construction of a tunnel for the purpose of conveying water from the works of the Derwent Valley Water Board at Ladybower, to the works of the Sheffield Corporation in the Rivelin Valley, a total length of nearly five miles, of which a length of about 1,700 yards has already been driven.

The gentleman appointed will be required to reside in the immediate vicinity of the Tunnel works, and to devote the whole of his time to his duties under the Corporation.

He will have daily personal charge of the work, and be responsible for it throughout, and will perform all special work and duties in connection therewith which the Water Committee of the Corporation may desire.

The staff of assistants, inspectors, and others is provided by the Corporation, and will be under the direction of the engineer.

The engineer will be required to confer with the consulting engineer with regard to all plans and designs, and at every step during the progress of the work, but without thereby lessening his own absolute responsibility, and he shall report direct to the Water Committee, from whom alone he will take instructions.

It is indispensable that candidates for the appointment should have had considerable experience both in the design and carrying out of similar works, either under a contractor or by administration under a public authority.

Applicants must state age, experience, present position, salary required, when at liberty, and forward copies of testimonials, and the names of two references.

Personal canvassing will be a disqualification.

Applications to be sent to me not later than Monday, the 28th day of November instant, endorsed "Rivelin Tunnel Engineer."

By order,
HENRY SAYER,
Town Hall, Sheffield, Town Clerk.
9th November, 1904.

BUYERS' DIRECTORY.

NOTE.—*The display advertisements of the firms mentioned under each heading can be found readily by reference to the Alphabetical Index to Advertisers on pages 23 and 25.*

In order to assure fair treatment to advertisers, each firm is indexed under its leading speciality ONLY.

Advertisers who prefer, however, to be entered under two or more different sections can do so by an annual payment of 5s. for each additional section.

Artesian Well Machinery.
John Z. Thom, Patricroft, Manchester.

Belting.
Binney & Son, Catherine Street, City Road, London, E.C.
Fleming, Birkby & Goodall, Ltd., West Grove, Halifax.
Rossendale Belting Co., Ltd., 10, West Mosley Street, Manchester.

Boilers.
Clayton, Son & Co., Ltd., Leeds City Boiler Works, Leeds.
Grantham Crank & Iron Co., Ltd., Grantham.
John Thompson, Wolverhampton.

Boilers (Water-tube).
Babcock & Wilcox, Ltd., Oriel House, Farringdon Street, London, E.C.
Cochran & Co. (Annan), Ltd., Annan, Scotland.

Bolts, Nuts, Rivets, etc.
Herbert W. Periam, Ltd., Floodgate Street Works, Birmingham.
T. D. Robinson & Co., Ltd., Derby.

Books.
E. & F. N. Spon, 125, Strand, London, W.C.

Cables.
St. Helen's Cable Co., Ltd., Warrington, Lancashire.

Case-Hardening Compounds.
Hy. Miller & Co., Millgarth Works, Leeds.

Catalogues, Printing, &c.
Atlantic Press, Ltd., Weymouth Street, Manchester.
Southwood, Smith & Co., Ltd., Plough Court, Fetter Lane, London, E.C.
Spottiswoode Advertising Agency, 8, New Street Square, E.C.

Chucks.
Fairbanks Co., 78-80, City Road, London, E.C.

Clutches (Friction).
David Bridge & Co., Castleton Ironworks, Rochdale, Lancashire.
H. J. H. King & Co., Nailsworth, Gloucestershire.

Colliery Plants.
Graham, Morton & Co., Ltd., Leeds.

Condensing Plant.
Concentric Condenser, Ltd., 23, Northumberland Avenue, London, W.C.
Mirrlees-Watson & Co., Ltd., Glasgow.

Consulting Engineers.
G. H. Hughes, A.M.I.M.E., 97, Queen Victoria Street, London, E.C.

Continental Railway Arrangements.
South Eastern & Chatham Railway Co.

Conveying and Elevating Machinery.
Adolf Bleichert & Co., Leipzig-Gohlis, Germany.
Brown Hoisting Machinery Co., 39, Victoria Street, London, S.W.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
Graham, Morton & Co., Ltd. Leeds.
Temperley Transporter Co., 72, Bishopsgate Street Within, London, E.C.

Coverings (Boiler)
Magnesia Coverings, Ltd., Washington Station, co. Durham.

Cranes, Travellers, Winches, etc.
Joseph Booth & Bros. Ltd, Rodley, Leeds.
Thomas Broadbent & Sons, Ltd., Huddersfield.
Niles-Bement Pond Co., 23-25, Victoria Street, London, S.W.

Cranks.
Clarke's Crank & Forge Co., Ltd., Lincoln, England.

Cutters (Milling).
E. G. Wrigley & Co., Ltd., Foundry Lane Works, Soho, Birmingham

Destructors.
Horsfall Destructor Co., Ltd., Armley, Leeds.

Dredges and Excavators.
Delange & Cie, Mce., Hoboken, near Antwerp.
Lobnitz & Co., Ltd., Renfrew.
Rose, Downs & Thompson, Ltd., Old Foundry, Hull.

Economisers.
E. Green & Son, Ltd., Manchester.

Ejectors (Pneumatic).
Hughes & Lancaster, 47, Victoria Street, London, S.W.

Electrical Apparatus.
Allgemeine Elektricitäts Gesellschaft, Berlin, Germany.
Broadbent, T. W., Victoria Electrical Works, Huddersfield.
Bruce Peebles & Co., Ltd., Edinburgh.
Brush Electrical Engineering Co., Ltd., Victoria Works Belvedere Road, London, S.E.
Crompton & Co., Ltd., Arc Works, Chelmsford.
Crypto Electrical Co., 3, Tyer's Gateway, Bermondsey Street, London, S.E.
Gent & Co., Ltd., Faraday Works, Leicester.
Greenwood & Batley, Ltd., Albion Works, Leeds.
India Rubber, Gutta Percha, and Telegraph Works Co., Ltd., The, Silvertown, London, E.
Mather & Platt, Ltd. Salford Iron Works, Manchester.
Matthews & Yates, Ltd., Swinton, Manchester.
Mix and Genest, Berlin, W., Germany.
Nalder Bros. & Thompson, 34, Queen Street, London, E.C.
Newton Brothers, Full Street, Derby.
Phœnix Dynamo Manufacturing Co., Bradford, Yorks.
Premier Electrolyte Co., 26, Spital Square, London, E.
Simplex Steel Conduit Co., Ltd., 20, Bucklersbury, London, E.C.
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Hudswell, Clarke & Co., Ltd., Leeds, England.

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Soest, L., & Co., Ltd., 114-116, Victoria Street, London, S.W.

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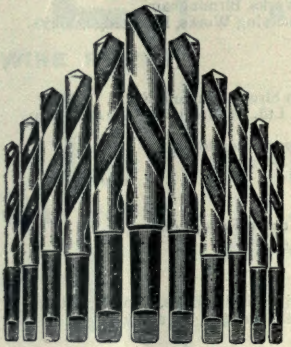

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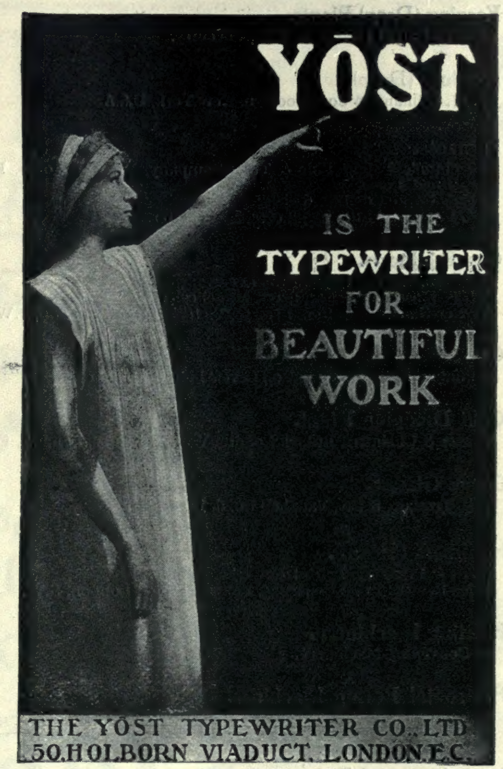

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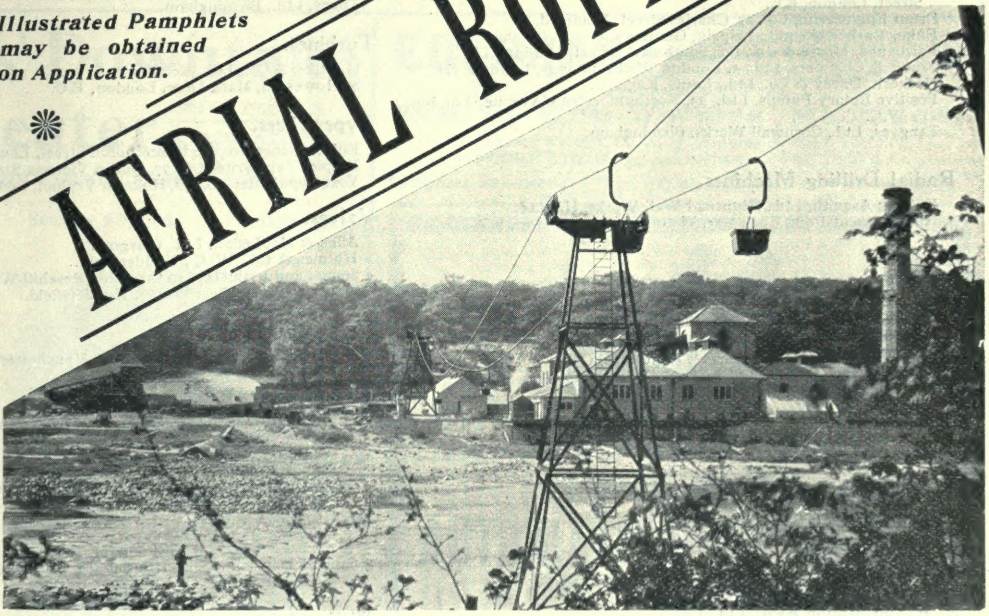

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Cambridge Scientific Instrument Co., Ltd. Cambridge.

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Thornycroft & Co., Ltd., J. I., Chiswick, London, W.
Yorkshire Patent Steam Wagon Co., Pepper Road, Hunslet, Leeds.

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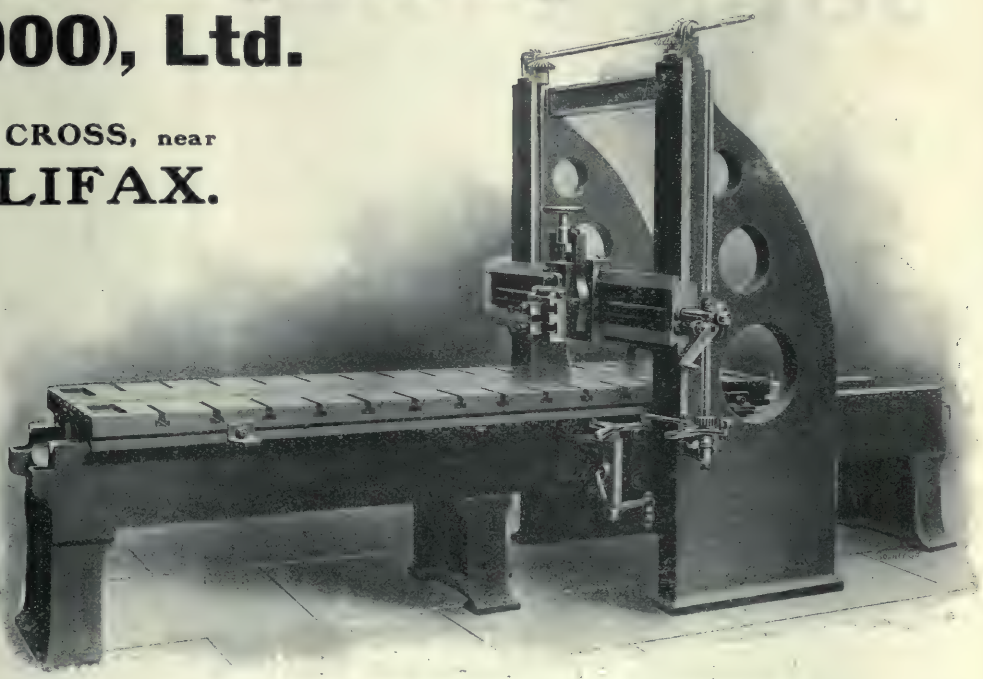

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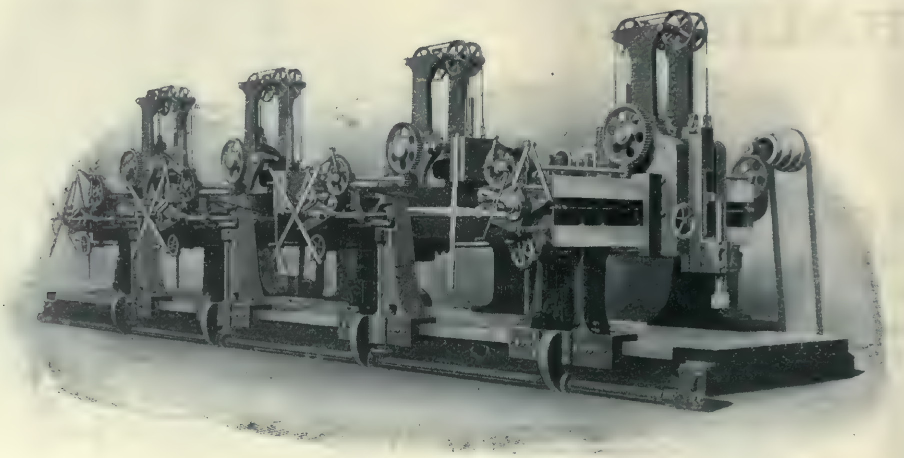

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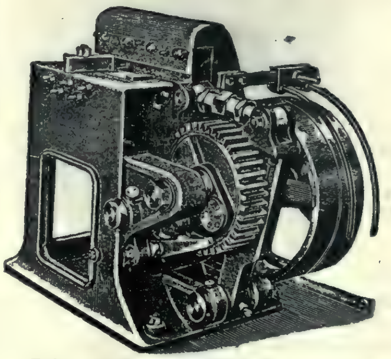

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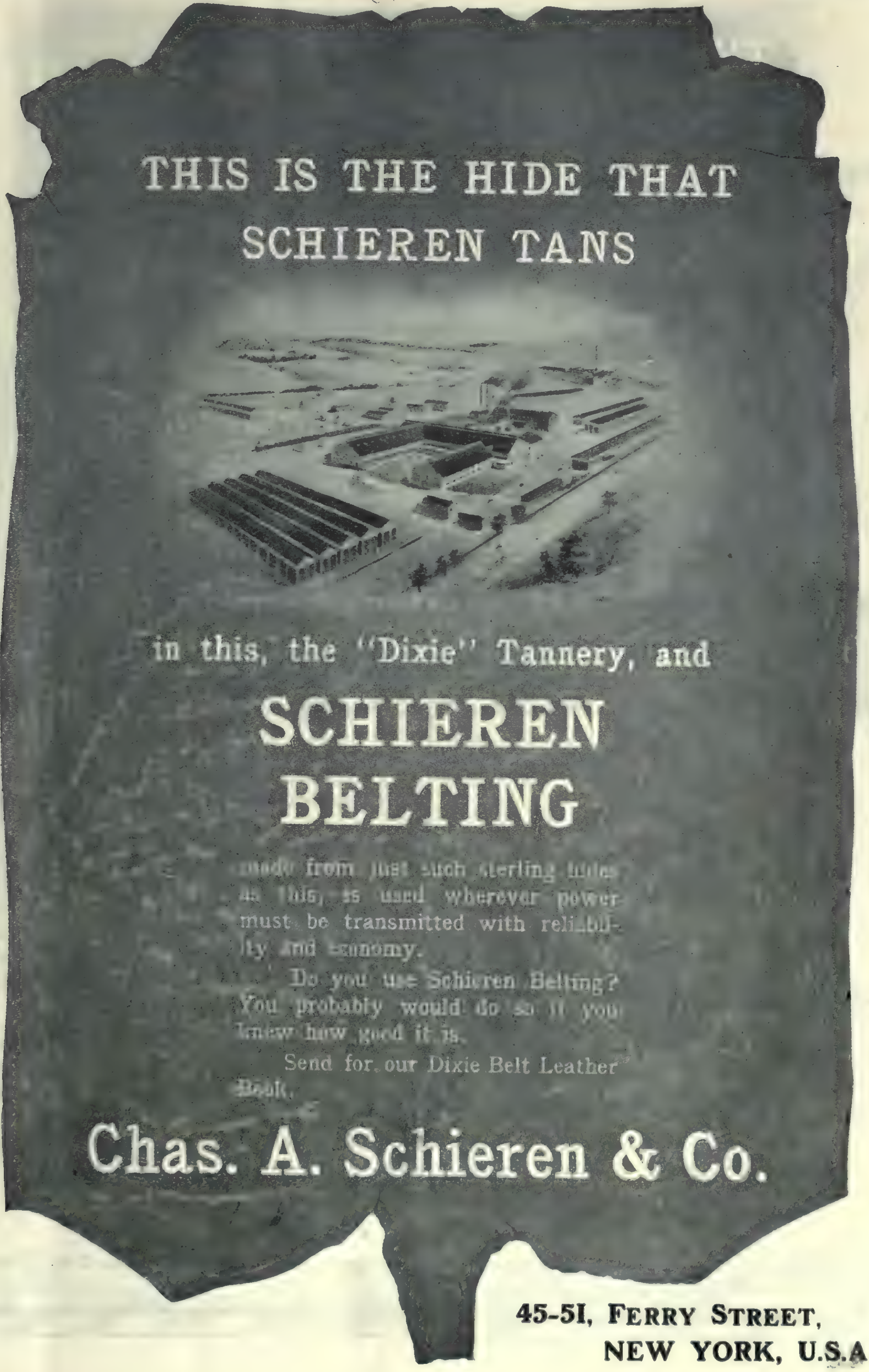

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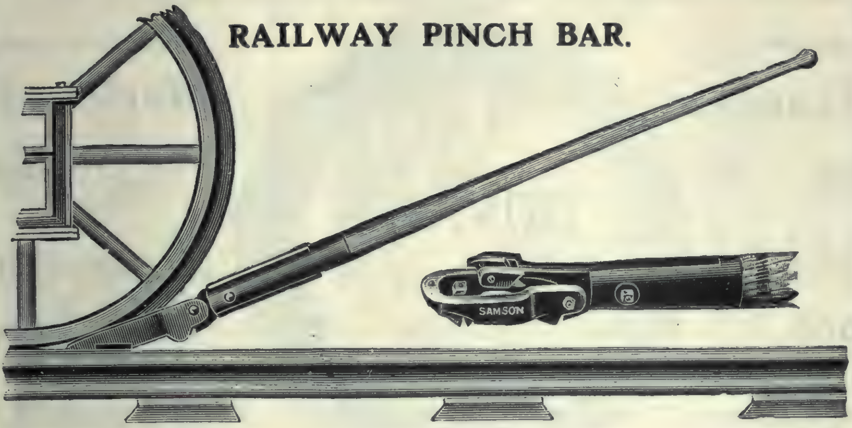

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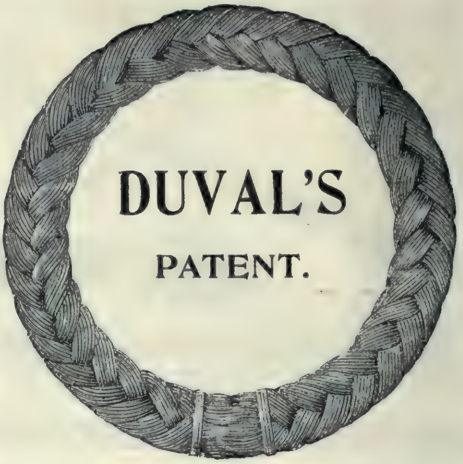

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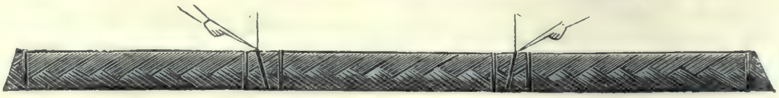

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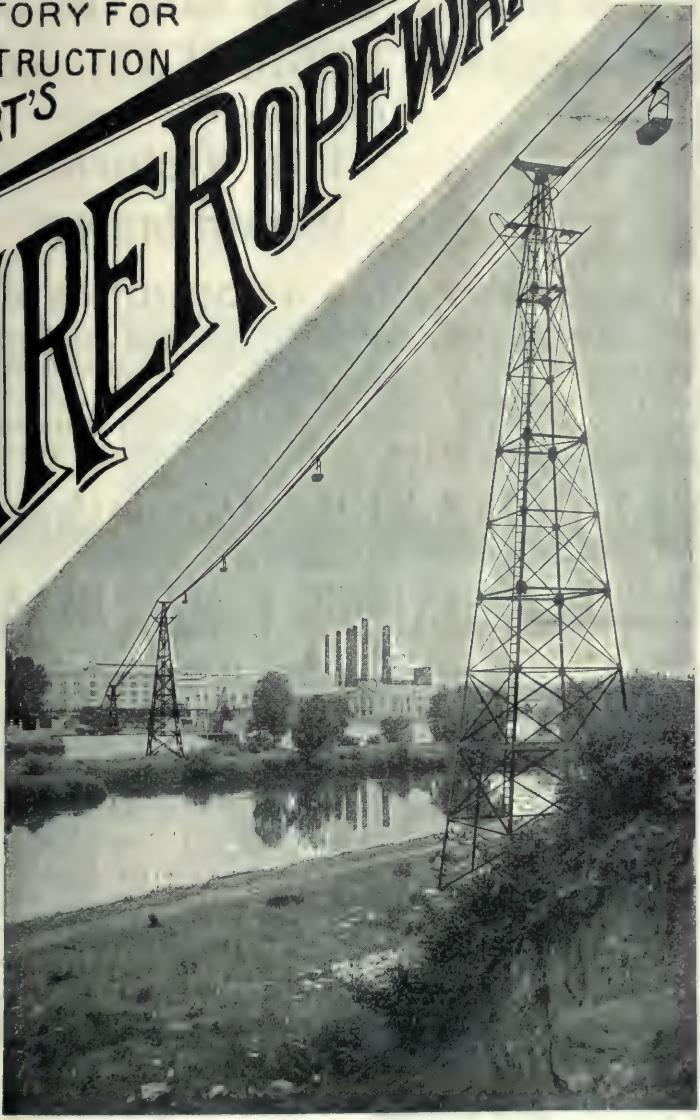

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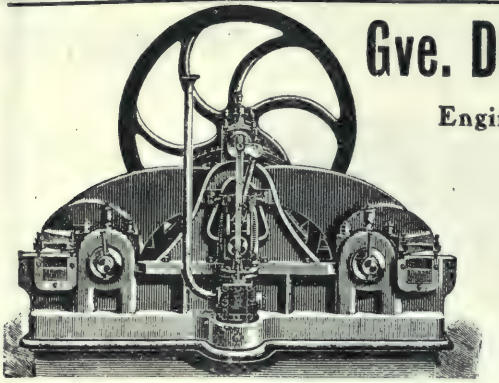

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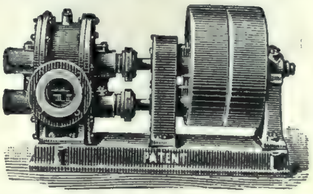

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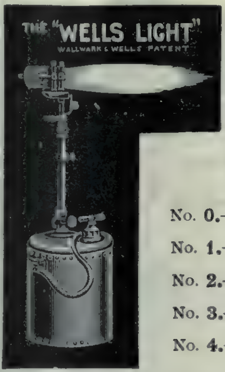

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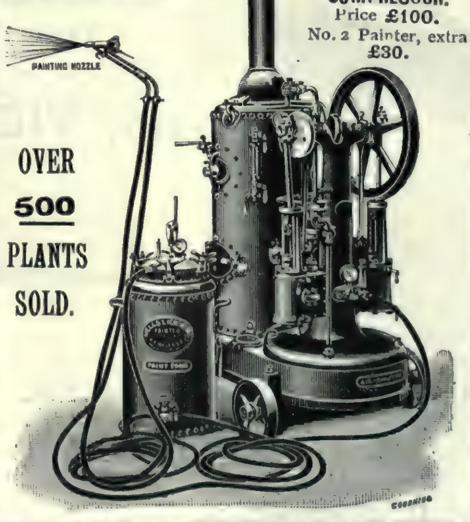

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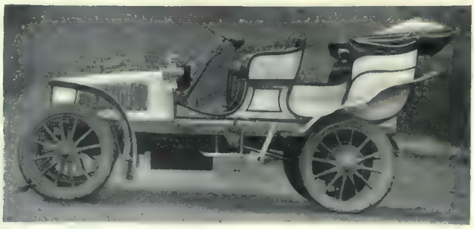

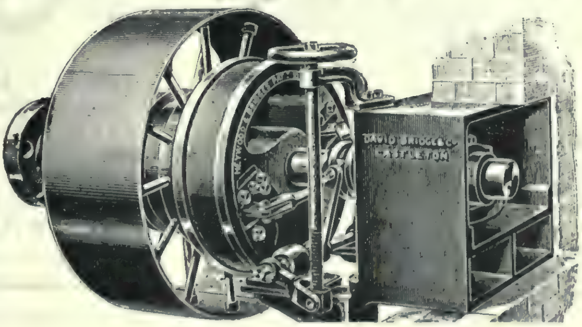

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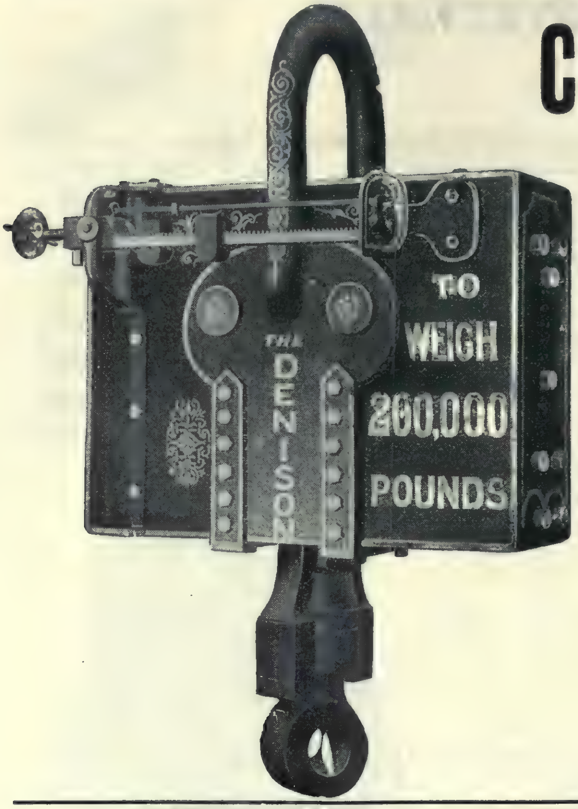

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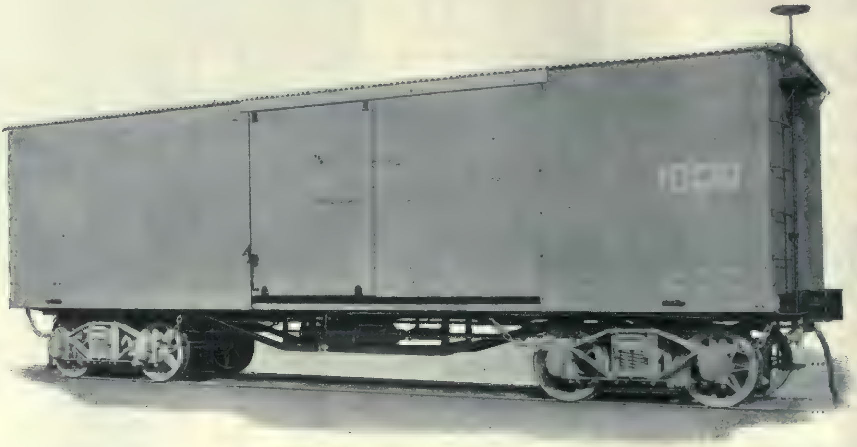

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PAGE'S WEEKLY

An Illustrated Technical Weekly, dealing with the Engineering, Electrical, Mining, Iron and Steel, and Shipbuilding Industries.

Vol. V. LONDON, FRIDAY, NOVEMBER 18, 1904. No. 10.

The Offices of "Page's Weekly," Wednesday, Midnight.

ALMOST everyone, however remote his knowledge of engineering appliances may be, is more or less familiar with the ordinary steam-hammer. It is, however, given to comparatively few—and to them generally through an experience they would not care to repeat—to make the acquaintance of the water-hammer. Being myself one of this privileged class, I propose to qualify my readers all and sundry, without the usual initiatory ceremonies, which far transcend, in the matter of personal risk to the candidate, those of any secret society in the pages of fiction.

Some months ago I was called upon to undertake an examination of a new horizontal steam-engine by the owner, who desired independent testimony that all was as it should be. It was while preparing to take an indicator diagram that something occurred which projected me in—I am glad to think—a purely parabolic curve, to a considerable distance (including a vertical drop of some six feet) upon the floor of the engine-room. Clouds of steam and a deafening roar lent their aid to these impressive rites, and for some little time "the subsequent proceedings interested me no more." It is such an experience as this that I am anxious to spare my readers.

What had happened was simply this: The attendant had gone into the boiler-house, all unknown to me, and had opened the stop-valve on the boiler, preparatory to starting the engine, leaving the stop-valve at the cylinder closed. No doubt the first-named valve was not perfectly steam-tight, and as the result of many hours' leakage in this way, the long horizontal undrained steam-pipe had become charged with water—possibly a quarter the area of the pipe was lying submerged in this way.

SIR J. FORTESCUE-FLANNERY BART, M.P., J.P.,

Whose baronetcy was announced in the list of birthday honours. (*See page* 625.)

The effect of turning on the steam full-bore at the boiler would be to heap up the water before it into the form of a solid plug, and to propel this improvised projectile—I will not say with terrific violence, because that is unprofessional—but with sufficient force, accumulated during its passage of twenty feet or so, to drive it straight through the back of the cast-iron bend underneath the engine stop-valve, leaving a 3-in. round hole in the curved surface of this bend, as clean as the proverbial whistle, through five-eighths of an inch of good solid cast-iron.

This little incident had passed, with many other of those trifling adventures which serve to vary the monotony of an engineer's existence, into the limbo of half-forgotten experiences, until I was reminded of it by three Board of Trade "Reports on Boiler Explosions," which have just come to my notice.

I give a brief extract of each of these, commending those who desire further information to the Reports themselves, which are Government publications, procurable through any post office or bookseller.

No. 1511.—. . . The valve was fixed in the middle of a long horizontal length of steam-pipe. This had an automatic drain-cock at the end, but it was useless for draining the length of pipe between boiler and valve, when the latter was closed. The "explosion" occurred when the fireman was in the act of closing the valve, and was due to "water-hammer" set up by the action of the steam on the water which had lodged in the pipe. The top of the valve-chest was blown off, and the escaping steam so severely scalded the attendant that he died the same day.

No. 1471.—. . . The valve was broken all round the flange, and the steam escaped full bore into the engine-house at 70-lb. pressure, but fortunately no person was injured. Water accumulated in the steam-pipe by condensation, and was driven forward by the rush of steam, and this fractured the stop-valve. The result might have been disastrous, as the engine to which these boilers supplied steam was at the moment winding a cage from the pit. The engineman being driven from his post by the escaping steam, the cage, which, fortunately contained only minerals, was overwound.

No. 1472.—Very much the same as the foregoing, but with the sad addition that two men were scalded to death.

I earnestly hope that the publicity given through Page's Weekly to these reports may have the result that every steam user who reads these lines will at once take steps to see that his steam-pipes are thoroughly drained, and his boiler-attendants instructed to make use of the drain-cocks regularly.

One is less inclined to marvel at the extraordinary efficiency of the Japanese naval officers, on reading the paper upon this subject which was presented to the Royal United Services Institution, by Lieut.-Commander K. Sato, on the Education of Imperial Japanese Naval Officers of the Executive branch. At the very outset, a system of winnowing is employed which can scarcely fail to eliminate all candidates who can by any stretch of imagination be deemed undesirables. For instance, in the entrance examination last year, 1,995 candidates presented themselves, of whom 1,400 passed the physical examination. The candidates who passed the qualifying examination in all respects, numbered only 400, while the actual number selected to enter the Imperial Naval College at Yetajima, was only 180. A very great deal of attention is given to the study of English.

In the discussion which followed the paper above alluded to, Rear-Admiral J. Inglis, who was formerly engaged in attending to the higher education of naval officers in Japan, said that the Japanese nation was, as far as he knew, unique. Nothing that he had ever come across in any part of the world was the least like it. They combined every good qualification of the Eastern with every good qualification of the Western; they had the patience, the cleverness, and the cunning, used in its best sense, of the Eastern; combined with that they had the "shove" and "go" of the American who comes from San Francisco, or the Southern Frenchman or Italian. Nothing had been seen like it, as far as he knew, in the modern world's history.

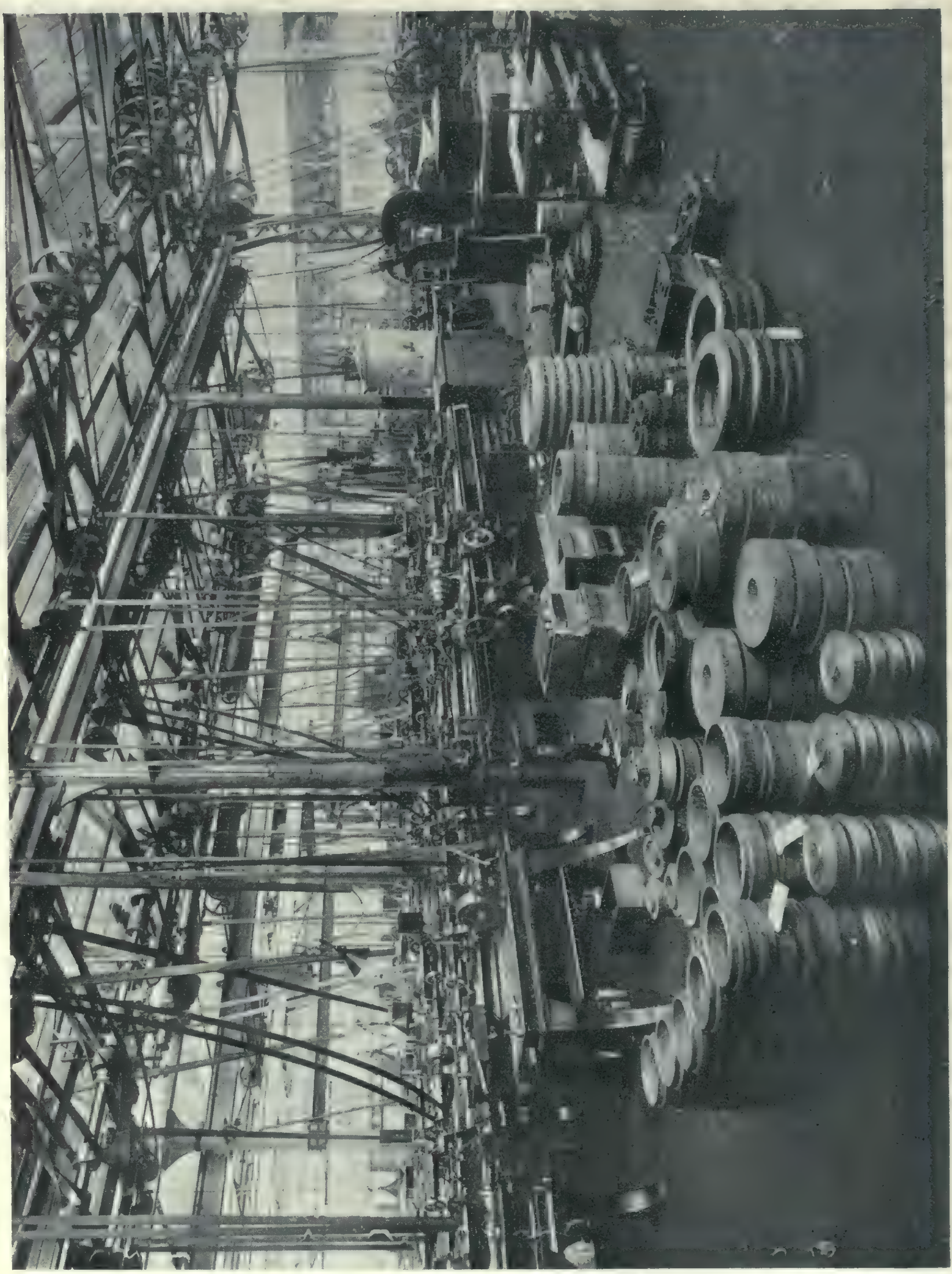
He also remarked that in every respect the Japanese had verified the old spirit of the Samurai. They are a fighting nation. If they have had to give up fighting in the old two-handed sword manner, they have adapted themselves in a most wonderful way to fighting with the modern rifle, the modern gun, and the modern ship. The Japanese naval officer not only knows how to learn; he knows how to obey.

With regard to the part which our own universities are playing in the development of the Japanese, one of our daily contemporaries points out that since the early seventies, or thereabouts, when the first Japanese, Mr. Kikuchi, entered at Trinity, Cambridge, a continuous stream of young Japanese have passed through one or the other of our Universities. not a few distinguishing themselves in the Honours schools. Cambridge, with its mathematical bias and more practical training, seems to offer greater attractions to the Japanese intellect than classical and philosophic Oxford, At present there are some fifteen at Cambridge and five at Oxford.

Yoshio Kinoshita, who fills the important post of general passenger agent of the Imperial Government Railways of Japan, has arrived in the United States, and is making a thorough study of American railroad methods in so far as they apply to passenger department affairs. He expects to spend two years in America and Europe before returning to Japan. The purpose of his visits is to familiarise himself with up-to-date methods in handling passenger traffic, with a view to raising the standard of service on the Japanese lines.

The advent of the Chinese in South Africa is now an accomplished fact. Over 13,000 Chinese workers have already arrived and 11,000 more are on their way. The beri-beri bogey and the cry of slavery have died away, and even the Chinese miner's suit which was exhibited in Fleet-street, does not seem to have materially affected the success of the experiment. We hear already of a general improvement in South African affairs, which is by no means confined to the mining industry. The total value of the output from the mines for the nine months ended September of this year, has exceeded by half-a-million that of the corresponding period in 1898, the year preceding the war. Since the arrival of the Chinamen the number of white men employed in the mines has been increased by 1,700.

An extraordinary session of the Intercolonial Council, convoked for the purpose of ratifying several agreements for the construction of new railways in the two colonies was opened by Lord Milner this week at Bloemfontein. In his opening address, Lord Milner referred to the gratifying character of the unforeseen circumstances which necessitated the summoning of the council. When the last session took place in June, however necessary many of the new lines might have been for the development of the country, there was little prospect of their being built for some time to come; but, in the interval, the prospects of the new colonies, so far as railway construction was concerned, had changed vastly for the better. There had been a revival of confidence in the immediate future of the country. The feeling that the fundamental conditions had improved,



SMALL LATHE DEPARTMENT IN THE WORKS OF THE DE LAVAL STEAM TURBINE COMPANY AT TRENTON, N.J. (*See page* 631.)

and that the time for important development was near at hand, was shared both by individuals and by the Governments, and a desire obtained on all sides to participate in that development.

Lord Milner remarked that railway receipts remained poor, but with the substantial economies which had been effected they could look to the future with confidence. Resolutions were passed at the last session of the council entrusting the High Commissioner with the carrying out of necessary reforms in railway administration. These were in course of being introduced, and details would be more fully explained at the next ordinary session. In outline, the reforms provided for the abolition of the office of Railway Commissioner, and the centralisation of the executive authority in a general manager, subject in all matters of policy, and especially of financial policy, to a board of control representing and deriving its authority from the council. The Board of Control will be the Railway Committee, but the present constitution of the latter will be modified.

Lord Milner replied to various criticisms passed on the principle underlying the agreements for the construction of the proposed lines. In every case, he said, the new colonies were getting something for nothing. He failed to see why a bargain, which by common consent conferred great and much-needed benefits on the colonies, should be objected to simply because the other party derived benefits as well from the transaction. Naturally the Natal and Cape Governments and De Beers were not going to force these favours on the colonies for love of them. They had their own objects in view, but these objects in no way hurt the new colonies. The construction of the proposed lines would bring a very great and almost unhoped-for good fortune to the country. They would fill up some most flagrant gaps in the railway map of South Africa.

HONOURS FOR ENGINEERS.

The list of birthday honours includes several items of exceptional interest to engineers. The career of Sir J. Wilson Swan, F.R.S., is dealt with in another page, and it is therefore unnecessary to do more here than offer him our hearty congratulations upon an honour which, although somewhat belated, has at least been thoroughly earned. The incandescent lamp is in our day such an ordinary feature of everyday life, that we are somewhat apt to forget the pioneers to whom we are indebted for its development. Sir J. Wilson Swan has certainly earned the gratitude of millions.

The steam turbine is bringing about such a rapid revolution in the engineering world that possibly we do not yet see the inventors who are responsible for its development in proper perspective, but we are pleased to observe the name of the Hon. C. A. Parsons, D.Sc., F.R.S., in the present list of birthday honours, and we do not think that anyone will grudge him the distinction of C.B.

Another engineer of note who is mentioned in the list is Sir James Fortescue Flannery, Bart., whose portrait appears on page 621. Sir Fortescue Flannery is well known as a consulting engineer, and as Member of Parliament for the Shipley Division of Yorkshire. He was born at Liverpool in 1851, being the eldest son of Captain John Flannery, and was educated at the Liverpool School of Science. He commenced his engineering career at the Britannia Engine Works, Birkenhead, and subsequently acted as inspecting engineer under Sir E. J. Reed. He is ex-President of the Institution of Marine Engineers. Sir Fortescue Flannery received the honour of knighthood in 1899, and we have now the satisfaction of congratulating him upon becoming a baronet.

Sir J. A. Bellamy, one of the new knights, has rendered valuable service in connection with technical education, and has also done good service in the promotion of electrical communication between lighthouses and the shore.

PAGE'S WEEKLY

An Illustrated Technical Weekly, dealing with the Engineering, Electrical, Mining, Iron and Steel, and Shipbuilding Industries.

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Telephone No: 3349 GERRARD.
Telegraphic and Cable Address: "SINEWY, LONDON."

Editorial.—*All communications intended for publication should be written on one side of the paper only, and addressed to "The Editor."*

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Post free to any part of the world—In advance, 16s. for twelve months.

Sample Copies: United Kingdom, 6d., post free; Abroad, 8½d. post free.

Remittances should be made payable to PAGE'S WEEKLY, and may be forwarded by Cheque, Money Order, Draft, Post Office Orders or Registered Letter. Cheques should be crossed "LONDON & COUNTY BANK, Covent Garden Branch. P.O.'s and P.O.O.'s to be made payable at East Strand Post Office, London, W.C. When a change of address is notified, both the new and old addresses should be given. All orders must be accompanied by remittance, and no subscription will be continued after expiration unless by special arrangement. Subscribers are requested to give information of any irregularity in receiving the Weekly.

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Alterations, &c., intended for insertion in the current week's issue must be delivered **not later than 4 p.m. on Monday.** If proofs are required the copy and blocks should reach us several days earlier.

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NEWS ITEMS.

Sir William Garstin, at present Under-Secretary of State for Public Works in Egypt, has been appointed adviser to the Khedive in affairs relating to public works.

Mr. Andrew Carnegie is a difficult man to succeed as the President of a great institution, but the Iron and Steel Institute is to be congratulated in securing Mr. R. A. Hadfield for its President next year.

On Tuseday the Board of Trade inquiry into the circumstances of the North Sea outrage was opened at Hull before Admiral Sir Cyprian Bridge and Mr. B. Aspinall, K.C. Dr. H. Woodhouse watched the proceedings on behalf of the Russian Government. Admiral Bridge announced the inquiry would be divided into two parts, the first relating to the occurrences which took place, and the second to damages and claims.

An American contemporary records a new record in track-laying established by the construction department of the San Pedro, Los Angeles and Salt Lake Railways. Recently the steel gang accomplished the feat of laying 9,320 ft. of track in one day. This has stirred the foreman on to further feats, until now it is their ambition to lay an even two miles of rails in a single day.

The International Jury of Award of the St. Louis Exhibition have awarded a silver medal to the Pulsometer Engineering Company, Ltd., of Reading for the "Geryk" vacuum pump, and a bronze medal to the inventor, Mr. H. A. Fleuss. The C. W. Hunt Company, of West New Brighton, New York, have secured highest awards for two exhibits. The Hunt "Industrial" Railway receive the gold medal for narrow-gauge railways, and the electric storage battery locomotive built by that company received the silver medal, being the highest award for this type of locomotive.

In the notice of Professor Goodman's "Mechanics Applied to Engineering," which appeared in our last issue, our reviewer, owing to a derangement of paragraphs, was made to attribute to the author a line of reasoning to which he is strongly opposed. Professor Goodman was made responsible for the following opinion: "The actual breaking strength of a beam is very much higher than the breaking strength calculated by the beam formula adopted, hence much greater stresses may be allowed on beams than on the same material in tension and compression." On referring to the paragraph p. 391 of the book, readers will see that they are particularly warned against such reasoning.

The Telephone Question.

A recent report by the Postmaster-General states that owing to the great extent of the London exchange area, and the number of its local exchanges, the proportion of junction lines required is probably greater than in any other local exchange system in the world. The average cost of construction has increased since the last report from £18 11s. 4d. per mile of double wire to £18 16s. 10d. Including the cost of installation of telephone instruments and of exchange apparatus, the total cost of each subscriber's line has increased from £38 6s. 4d. to £41 9s. 8d. This does not include the cost of the spare wires which are necessary for the maintenance of an exchange system in an efficient state.

Naval Observatory Time Service.

Rear-Admiral C. M. Chester, U.S.N., in the course of a paper on the "Work of the Naval Observatory," contributed to the United States Naval Institute, gives an instructive account of the Department of Chronometers and Time Service. Not a day goes by but that many thousands, if not millions, of people set their watches by the click of the clock in this department's wing of the Observatory building. The clock, regulated by the transit of stars practically on every clear night, is attached, through the vast network of telegraphic wires which bind together the innumerable stations from the Rocky Mountains to the eastern borders of the land, to some 50,000 sister clocks in the Western Union system alone. And at each day, noon, in nearly every telegraph office of the country, one may learn the time to the tenth of a second. This time service has been brought about by a process of evolution. Beginning with small experiments carried on as early as 1816, when one Rolands, an Englishman, connected two clocks together with some 500 ft. of wire, really for the purpose of distributing electricity rather than that of distributing time, it has grown to enormous proportions. As in the astronomical work, a naval officer was the first to carry out the practical idea of transmitting time from point to point. The officer referred to was the late Rear-Admiral Wilkes, who built the first observatory of the country on Capitol Hill.

The necessity of giving the time of mean noon to the navigators and others in New York Harbour and other distant places soon gave improved methods for its distribution by electricity, and for dropping a time ball from some prominent tower; thus, from small beginnings, a service was organised which carries the time from Washington to all parts of the country.

Sleepers on the Siberian Railway.

The soft pine employed in constructing the trans-Siberian Railway very soon proved its unsuitablity for sleepers. According to a contemporary, the existing permanent way requires continual attention. The rails are light—50 lb. or 60 lb.—and are laid upon transverse wooden sleepers in ballast, which for the most part consists of black soil without stone or gravel. The result is that subsidences are frequent, notwithstanding that the sleepers are placed unusually close together. Then the soft pine of which the sleepers are made quickly rots, the more so since no preservative measures are adopted, and the necessity for frequent renewal is shown by the heaps of rotting sleepers that lie along the line.

Transvaal Technical Institute.

In view of the valuable work which Professor Hele-Shaw has done for technical education in the Transvaal, it may be well to give a brief history of the "Transvaal Technical Institute." This was inaugurated in 1903 by the Lieut.-Governor of the Transvaal, on the recommendation of a Commission appointed by him to inquire into the steps necessary for the founding of an institution which should form part of a teaching university. A council was appointed, consisting of Mr. Fabian Ware, M.L.C., Director of Education (chairman), and the following members: Messrs. H. S. Caldecott, G. S. Corstorphine, W. P. Fraser, S, J. Jennings, W. F. Lance, J. G. Lawn, G. A. F. Molengraaff, Theo, Reunert, F. B. Smith, H. Weldon, and John Robinson (secretary).

The council secured the temporary use of a building in Kerk Street, with additional accommodation in Von Brandis Square. On March 2nd, 1904, the Institute commenced work with forty students. Professor Hele-Shaw, LL.D., F.R.S., acting temporarily as Senior Professor, with the general supervision of the educational work, assisted by Professors Orr, Robertson, Dobson, Wilkinson, and Young. The original intention was, in the meantime, to carry on the third and fourth years' courses of the S.A. School of Mines, Kimberley, which, with the starting of the Technical Institute, has ceased to exist as far as day students are concerned. Arrangements have, however, been made for carrying on complete courses in mining, mechanical, electrical and civil engineering for the contemplated diplomas of the Institute, in addition to the degree in mining of the Cape University. The subjects taught include engineering, mining, and metallurgy, electrotechnics, geology, physics, mathematics, and chemistry.

Engineer Mayors.

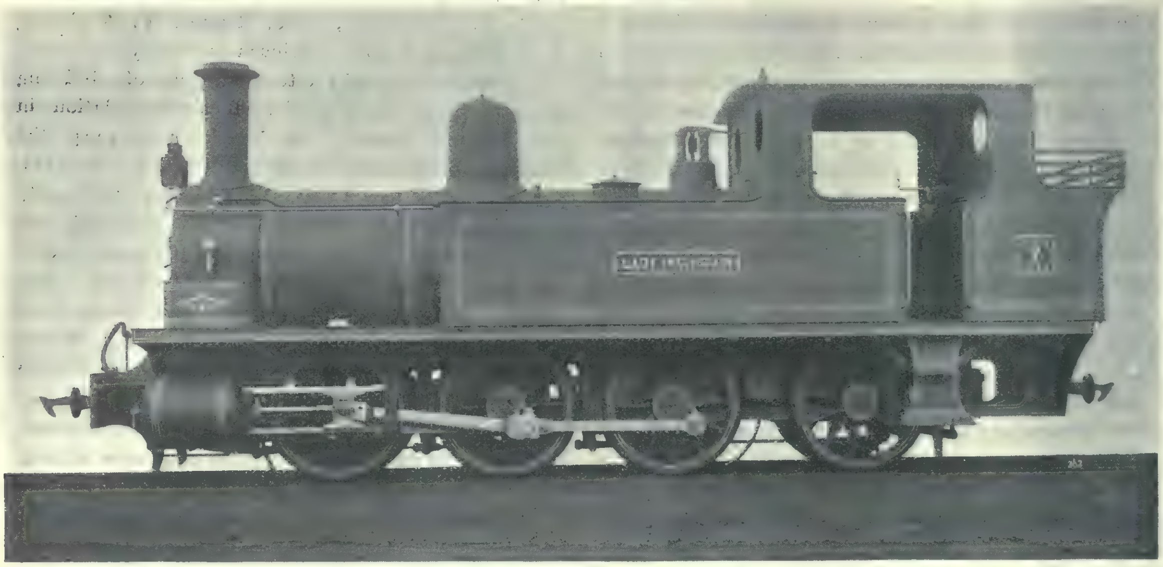
Alderman C. A. Head, of the firm of Head, Wrightson, and Co., Ltd., engineers and iron founders, of Thornaby and Stockton-on-Tees, has been elected Mayor of Thornaby for the ensuing year. Among other engineers who find time for municipal affairs is Mr. Malcolm Dillon, general manager of Palmer's Shipbuilding and Iron Company, Ltd., who for the second successive year has been elected Mayor of Jarrow. Another notable mayoralty is that of Alderman Isaiah Oldbury, who is now occupying the civic chair of Wednesbury for the fifth time. Mr. A. J. Dorman, of the firm of Dorman and Lang, has just received the freedom of the borough of Middlesbrough in recognition of his services to the town during the last twenty-five years.

A Notable Engine.

We illustrate below by the courtesy of the North British Locomotive Company, Ltd., a notable engine built for the West Clare Railway Company, This six-coupled tank engine, known as "Lady Inchiquin" has the following chief dimensions: Diameter of cylinders, 15 in.; stroke, 20 in.; grate area, 11·187 square feet; superficial area of inside fire box, 73·82 square feet, superficial area of inside tubes, 666·57 square feet; total, 740·39 square feet; diameter of wheels, front, 4 ft.; diameter of wheels, centre, 4 ft.; diameter of wheels, hind, 4 ft.; rigid wheel base of engine, 9 ft. 6 in.; total wheel base of engine, 15 ft.; weight of engine in working order, 35 tons 12 cwts. 3 qrs.; tank capacity, 930 gallons; fuel space equal to 80 cubic feet; gauge of railway, 3 ft.

Mr. Alfred Mosely at Birmingham.

Mr. Alfred Mosely, distributing the prizes at the Birmingham Municipal School, on Tuesday, said that American educationists aimed first at making good and loyal citizens, and while they never lost sight of the ideal, their great object was that every boy should be turned out fitted for some definite calling in life, regard being paid to his individual capacities. America differed from us in intense belief in education, and the realisation by manufacturers of the value of the thoroughly-trained college student in their factories. We were face to face with a condition of things which was somewhat alarming. A scientific education had become an absolute necessity if we were to hold our place industrially. We had an Empire such as those who had not travelled did not realise, an Empire teeming with natural resources in every direction, merely awaiting the skilled hands of the mechanic and farmer to develop them.



SIX-COUPLED TANK ENGINE, BUILT BY THE NORTH BRITISH LOCOMOTIVE COMPANY, LTD., FOR THE WEST CLARE RAILWAY.

NAVAL NOTES.

WEEKLY NOTES ON NAVAL PROGRESS IN CONSTRUCTION AND ARMAMENT.

(BY OUR NAVAL CORRESPONDENT.)

THE British Navy this week performs a more congenial task than that of shadowing an irresponsible and bellicose fleet. The reception to the King and Queen of Portugal at Portsmouth on Tuesday was the tribute of the British Navy to its own honorary Admiral and the head of a State which is *amie* if not yet *alliee*. King Edward placed his own yacht at the disposal of the visitors, and escorted by four armoured cruisers and two destroyers the *Victoria and Albert* steamed from Cherbourg into the lines of the Home and Channel fleets gathered in Spithead to salute King Carlos and his consort as they reached this country. The spectacle was a most imposing one, and contrasted pleasantly with the scene at Gibraltar a few days ago.

The *Essex* and *Bedford* armoured cruisers are to be transferred from the Home fleet to the Cruiser squadron, and the strength of that squadron is to be brought up to ten ships by the addition of the *Cornwall* and the *Cumberland*, both of which are now ready for commissioning. The squadron will then be divided into two parts, to be known respectively as the First and Second Cruiser squadrons.

No fewer than five vessels have been under trial during the past fortnight, all being the subject of favourable reports. The *Dominion* battleship, built and engined by Messrs. Vickers, Sons and Maxim, was the first, undergoing her trials under the new "war" conditions prescribed by the Admiralty. The engine rooms were completely closed in, ventilation being solely mechanical, the contractors' staff was limited to an equivalent to the service complement, and no extra oil for lubrication was allowed to be used. These conditions and others of a like mechanical and technical nature have been introduced, as many vessels which have attained their contract speed on trial have failed to do so afterwards under service conditions. The complete success of this first experiment proves the feasibility of the new method, and the following figures are proof. On the 30 hour' trial at one-fifth power the engines worked at 77·8 revolutions and indicated 3,889 h.p.; the coal consumption was 1·65 lb. per i.h.p. per hour; while the speed of the ship by log was 12·8 knots. On the succeeding 30 hours' trial at four-fifths power, the boiler pressure was 243·8 lb. per square inch, the vacuum 26·5 in.; the collective h.p. was 12,843; the consumption of coal was 1·68 lb. per i.h.p. per hour, and the speed by log was 18·3 knots. At the full-power trial of eight hours' duration, the speed attained, as an average of several runs over a long sea course in the Firth of Clyde, was 19·50 knots. The results of the engine performance were as follows: Steam pressure, 248 lb.; vacuum, 25·8 in.; revolutions of starboard engine, 125·80, port engine, 125·5; power of starboard engine, 9,270 i.h.p.; of port engine, 9,168 i.h.p.—together, 18,438 i.h.p.; the consumption of coal was 1·77 lb. per i.h.p. per hour.

During last week the *King Edward VII.* carried out her gun trials. The official reports state that these were satisfactory, but rumours in usually well-informed circles state that the discharge of the after 9·2 in. guns wrecked the deck for some feet around, and the guns' crew were completely prostrated. How far this is true cannot yet be told, but the programme for the steam trials to be carried out during this week has not at the time of writing been modified. The other three vessels under trial were the protected cruisers, *Topaze*, *Sapphire*, and *Diamond*. The *Topaze* has already undergone her contractor's trials, but on her voyage from Birkenhead to Devonport under charge of a navigating party she carried out a 24 hours' full power steam trial. The *Sapphire's* trials were completed satisfactorily at Jarrow and the results were as follows: On her 30 hours' one-fifth power trial, the average h.p. was 5,012 with a speed of 18·47 knots; on the eight hours' trial the h.p. developed was 7,281 with 20·6 knots as an average; and on the full-power trial the speed was 22·43 knots for 10,200 h.p.

The *Diamond* commenced her trials in the Firth of Clyde last week, but the results are not yet known.

The launch of the *Black Prince* at Blackwall last week is dealt with elsewhere in this issue, and it is therefore unnecessary for me to refer further to the matter. In my note last week on the armoured cruisers under construction, I stated that the *Orion* would be built at Pembroke and the *Defence* either by contract or at Portsmouth. This was of course a slip of the pen, the names of the vessels being reversed. It is the *Defence* which will be built at Pembroke, and the *Orion* whose fate has yet to be decided. And while on the subject, I would like to add my protest to the many others which are gaining ground against the incomprehensible names which have been given to our last nine armoured cruisers.

The *Duke of Edinburgh* is permissible, but clumsy, *Black Prince* is a complete misnomer, *Warrior*, *Achilles*, *Cochrane*, and *Natal* have absolutely no connection, and it requires a considerable effort of memory to keep in mind that they are all of the same class. But the height of absurdity is reached with this year's names: *Minotaur*. a horrible word to read or write, *Shannon*, *Orion*, and *Defence*. It is a vast pity that some system of naming is not adopted. There are still many "counties" unrepresented in the Navy list, and surely Pembroke is deserving of a place with Devonshire, Hampshire, and Kent! It is not yet too late to rename the *Defence*, and Pembroke is a name both historically and territorially interesting.

Another destroyer, the *Moy*, has been launched, but there is as yet no news as to the contracts for the fourteen vessels of the 1904–5 programme.

FRANCE.

From France comes once more only news of underwater craft. Six submersibles of the *Emeraude* type are to be laid down at Cherbourg, and are to be known as *Guepe* A 1–6. It is understood that these vessels mark a distinct advance on their prototypes, and the fact that they are to be built under the supervision of Naval Engineer Petithomme, who is attached to the technical section of the Ministry of Marine would seem to indicate that that gentleman is responsible for the improvements.

GERMANY.

Count Reventhlow, in an article in "Uberall," has been speaking very plainly about the design of the German battleships of the *N* or *Commas* class. Neither the ships building (*N*, *O*, and *P*), nor those for which the new estimates make provision (*Q* and *R*), satisfy modern conditions. He complains that the 6·7 in. guns of the *Braunschweigs* are of inferior calibre to those of the ships of the same age in other navies, and that the secondary armament of almost any foreign warship built during the last four years can pierce the armour of the *Braunschweigs*. He would have the two new vessels of larger displacement, carrying thicker armour and heavier armament. The armour should be from 8 to 8½ in. thick, and it is in the secondary armament that the increase in metal could be arranged for. The cruising speed of the vessels he would have 17 knots with bunker capacity for at least 2,000 tons of coal, and in addition some hundreds of tons of liquid fuel should be carried. The displacement might very well be 15,000 tons. Although all this would divide the newer vessels into two classes, Count Reventlow considers that the increase in fighting power would outweigh considerations of homogeneity.

The "new naval programme" has yet to be announced, and matters seem to point to the probability of its presentation to the Reichstag being indefinitely postponed. The deplorable state of the finances of the country, however, render it doubtful if any such measure would meet with support at the present juncture, and for the present the expansion of the fleet will not be insisted on.

RUSSIA.

The report has gained currency during the week that Russia has under consideration a new shipbuilding programme in which "the number of battleships and cruisers to be built is an unusually large one." In view of the situation in the Far East we are told the authorities will refrain for the present from fixing with any approach to definitiveness, either the total number of vessels to be laid down, or the number to be laid down of a certain category or class. The list of small craft includes 31 new destroyers, of which ten are building in Germany, 11 in France, and 10 more are about to be laid down in the Russian yards, which have now delivered to the Government all the vessels of the *B* class, commenced in 1899.

UNITED STATES.

The reports from Washington recently as to the number of vessels of various types which the General Navy Board was about to recommend Congress to authorise were slightly exaggerated, but in the main they were a good forecast. In place of five battleships, only three are to be commenced next year, and no armoured cruisers are recommended. Five scout cruisers, "six destroyers" and six torpedo boats make up the remainder of the shipbuilding programme for 1905, and the aggregate cost is to be some £8,250,000 (41,300,000 dols). There is an impression in the United States that the number of armoured cruisers built and completing is sufficient for their purpose. Particulars of the design of the battleships are not yet public, but they will presumably be large vessels, possibly 16,000 tons in displacement.

THE DE LAVAL STEAM TURBINE.

By courtesy of the De Laval Steam Turbine Company of New York, we are enabled to give our readers a pictorial representation of the first shops in America devoted exclusively to the manufacture of the steam turbine. These works, which are situated at Trenton, N.J., should also be interesting to English engineers by reason of the fact that the proprietors have adopted a principle of standardisation enabling them to turn out the parts of these prime movers on the interchangeable plan. Before proceeding to deal with the works, however, it may be interesting to briefly review the products, and to say something about the originator, the Swedish inventor—Dr. Carl Gustaf P. De Laval.

Like Sir Hiram Maxim, Dr. De Laval first turned his attention to agricultural machinery. His efforts to produce a commercially successful centrifugal cream separator were so radical that they met with general opposition, but to-day over 600,000 De Laval Cream Separators are in use in the agricultural world, and these appliances are turned out in enormous numbers by the American Separator Company at Poughkeepsie, New York. It was while engaged on the manufacture of his separator that Dr. De Laval became imbued with the necessity for a steam turbine as an ideal motor for driving the apparatus; hence the De Laval Steam Turbine.

Of the first De Laval turbine, built on the principle of the "Hero" engine, it is unnecessary to speak. His first commercially practical turbine was built in 1883, the inventor using it in direct connection with the shaft of the cream separator. In design and construction a reaction wheel, this was soon replaced by one of the Branca type; but, satisfactory as the results were, the steam turbine was yet very limited in its application, and comparatively wasteful of steam. In order to compete with the reciprocating steam engine it was necessary to introduce means for the complete expansion of the steam. If the true Branca type were to be further retained on account of its simplicity, as compared with a combination of the Branca and Hero types, the constructive difficulties arising out of the enormously high speed necessary had to be overcome. This De Laval aimed at and accomplished in a remarkable way. By use of the diverging nozzle, which he patented, he secured a complete and adiabatic expansion of the steam, and the conversion of its entire static energy into kinetic. Then, to overcome the impossibility of producing a wheel accurately enough balanced to revolve about its centre of gravity at a velocity sometimes as high as 1,350 ft. per second, without causing a side pressure destructive to plain bearings and a rigid shaft, he conceived the flexible shaft, which he also patented. These two inventions have placed the steam turbine in the foremost rank among heat promoters.

The speed of the De Laval Turbine Wheel, which for the maximum of efficiency should be about 1,880 ft. per second, or about 21 miles per minute, is, however, much lower, as it has been found difficult to produce a material for the wheels that with ample margin of safety would withstand the strains produced by the centrifugal force at this high speed. At the present time the speed does not

VIEW OF SMALL ERECTING SHOP IN THE WORKS OF THE DE LAVAL STEAM TURBINE COMPANY.

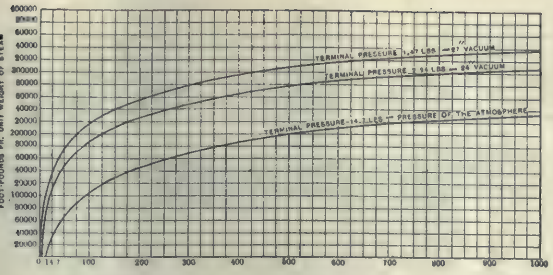
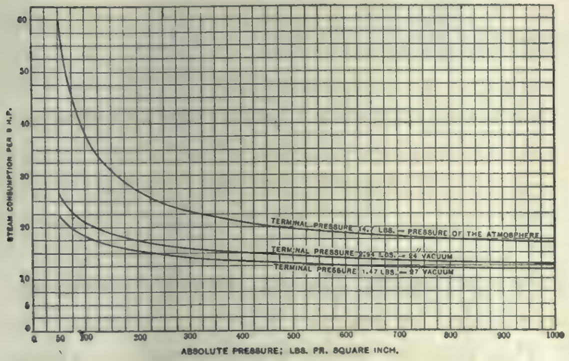


FIG. I. ENERGY OF A JET OF STEAM AT VARIOUS INITIAL AND TERMINAL PRESSURES.



IG. 2. ACTUAL STEAM CONSUMPTION PER. B. H. P. DE LAVAL STEAM TURBINE.

actually exceed 1,350 ft. per second, which would give a steam consumption of 9·8 lb. per theoretic h.p.

The diagram (fig. 1) gives the energy of a jet of steam in foot-pounds per unit-weight, and at different initial and terminal pressures.

At an initial pressure of 150 lb. per square inch absolute it will be seen that the energy of a jet issuing at a terminal pressure of 14·7 lb. absolute is 130,000 ft.-lb.; at a terminal pressure of 2·97 lb. it reaches 210,000 ft.-lb.; and if issuing at 1·47 lb. absolute, equal to 27 in. vacuum, the energy is 240,000 ft.-lb.

The curves in the diagram (fig. 2) show the steam consumption per b.h.p. or e.h.p. per hour, as actually obtained in practice with the De Laval steam turbine.

The importance of a high steam pressure and a good vacuum when operating the steam turbine is clearly shown by the above diagram. Not that the steam turbine cannot, as far as the mechanical results are concerned, be operated equally well with low pressures and non-condensing, and even then successfully compete with the reciprocating engine, but whenever the very best economy in operating is sought for, high pressure and a condenser should be used, and as the difference and gain in economy in the case of the steam turbine is more marked than in the reciprocating engine, it will be found advantageous in many cases, even in comparatively small sizes, to operate condensing, and even to do so in places where the scarcity of water would render the employment of a cooling tower necessary.

A characteristic feature of the De Laval steam turbine is that none of its running parts are subject to the full pressure of the steam, as the steam is fully expanded in the nozzle before it reaches the turbine wheel.

Further, a considerable increase in economy can be obtained by using superheated steam, for which the De Laval steam turbine is particularly well adapted, it having no running parts requiring lubrication, or packing glands in contact with the superheated steam; and, as in the case of high pressure, even here the limit exists alone with the boilers.

CONSTRUCTION OF THE DE LAVAL TURBINE.

The general construction of the De Laval steam turbine is no doubt well known to many of our readers, and it presents no extraordinary departure from every-day engineering practice. Fig. 3 shows sectional plan of a 30-h.p. De Laval turbine dynamo.

The turbine wheel mounted upon a slender flexible shaft is in such position relative to the wheel-case as to revolve with entire freedom, liberal space being allowed on each side. The wheel-case and the wheel-case cover are so shaped as to form safety bearings around the hub of the wheel for the purpose of catching and checking its speed in case of an accident to the shaft.

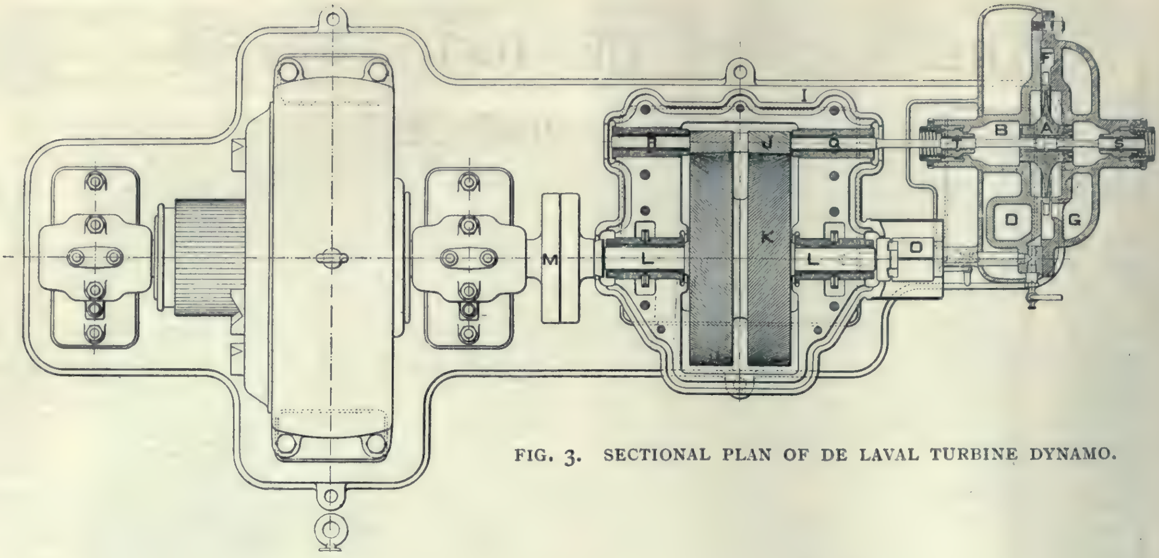


FIG. 3. SECTIONAL PLAN OF DE LAVAL TURBINE DYNAMO.

The steam, after passing through the governor valve, enters the steam chamber, where it is distributed to the various nozzles. These, according to the size of the machine, range in number from 1 to 15. They are generally fitted with shutting-off valves, by which one or more nozzles can be shut out when the turbine is not loaded to its full capacity. This allows steam of boiler pressure to be almost always used, and adds to the economy on light loads.

After passing through the nozzles the steam is completely expanded, and in blowing through the buckets F (fig. 4) its kinetic energy is transferred to the turbine wheel. After performing its work the steam passes into the chamber G (fig. 3), and out through the exhaust opening.

The velocity of the turbine wheel and shaft, in most cases too great for practical utilisation direct, is considerably reduced by means of a pair of spiral gears, usually made 10 to 1. The gear is mounted and enclosed in the gear case I (fig. 3). J is the pinion made solid with the flexible shaft and engaging the gear wheel K. This latter is forced upon the shaft L, which, with couplings M connects to the dynamo or is extended for pulley.

The flexible shaft is supported in three bearings (fig. 3). Q and R are the pinion bearings, and S is the main shaft bearing which carries the greater part of the weight of the wheel. This latter bearing is self-aligning, and is held to its seat by the spring and cap shown. T is the flexible bearing. This bearing is entirely free to oscillate with the shaft, and its only purpose is to prevent escape of steam when running non-condensing, or air from entering the wheel case when the turbine is running condensing.

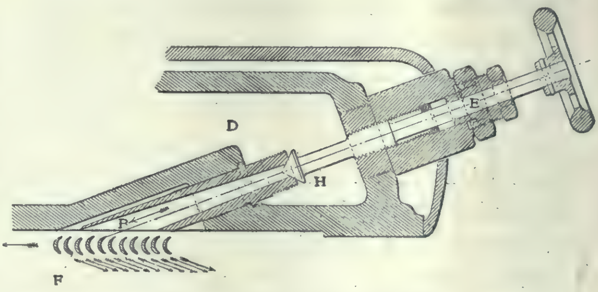


FIG. 4. DE LAVAL NOZZLE.

(*To be continued.*)

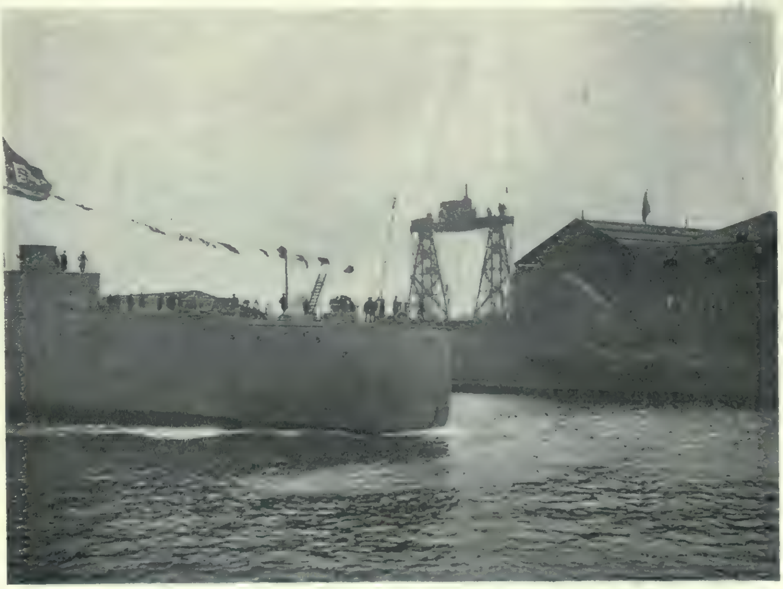
THE LAUNCH OF H.M. CRUISER "BLACK PRINCE."

THE accompanying illustrations, showing the launch of the new cruiser *Black Prince* at the Thames Ironworks, Blackwall, were taken by our representative in dull and windy weather. As will be seen from the illustration on this page, when the vessel entered the water, the sun showed a slight disposition to shine, which may be taken as a happy augury for the *Black Prince*. The new vessel is a first-class armoured cruiser cf the *Duke of Edinburgh* type, of which there are at present in all six under construction—two at the Royal Dockyard at Pembroke, and the remaining four at the yards of private contractors.

The *Black Prince* has a complete armour-belt running from stem to stern, the thickness amidships at water-line being 6 in., and tapering at forward end to 4 in., and 3 in. aft. The citadel, which is rectangular in shape, is protected by a 6-in. armour and carries ten 6-in. guns. On the upper deck there are five 9·2-in. guns in barbettes, protected by 6-in. and 3-in. armour; while forward, on the forecastle, is another 9·2 in. gun, making six in all. The foremost 9·2 in. gun and the aftermost one are situated at the middle line, so that an arc of fire of 310 deg. can be obtained. The other four 9·2 in. guns are placed at the sides of the vessel, and nearly over the ends of the citadel, and each of these commands a fire of 180 deg. On the shelter decks are 28 q.-f. guns, and there are also two Maxims and two 12-pounder 6-cwt. guns for boats and field use. The whole weight of armour is about 1,600 tons, exclusive of the protective decks.

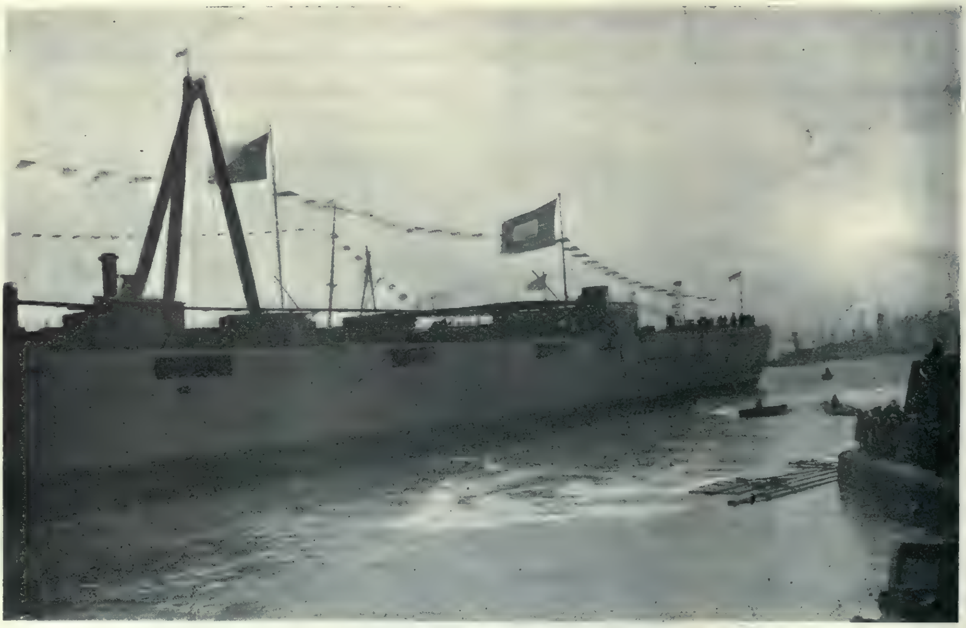
The battery has a protective deck covering of 1-in. steel, which is continued forward on the main deck. In addition, there is the sharp cambered protective deck $\frac{3}{4}$ in. thick at the water-line running right fore and aft.

As already stated, the dimensions of the vessel are: length, 460 feet between perpendiculars; extreme beam, 73 ft. 6 in.; depth for outer bottom to upper deck, 40 ft. 9 in.; draught forward, 26 ft. 6 in.; aft, 27 ft. 6 in.; displacement, 13,660 tons.



THE VESSEL ENTERING THE WATER.

THE "BLACK PRINCE" ON THE WAYS.



AFTER THE LAUNCH.

QUESTIONS OF THE DAY

III.—The National Encouragement of the British Inventor: How Can it be Secured?

(*Continued from page* 576.)

WE publish in the following pages a further selection of the correspondence received in the above discussion, which was inaugurated by Mr. B. H. Thwaite, C.E., in No. 7 of PAGE'S WEEKLY, and has been continued in the subsequent numbers. In order to place the discussion upon an even basis, we addressed a dozen questions to prominent readers and others, as follows:—

QUESTIONS ON THE PATENT LAWS.

1.—Do you consider that the new Act will offer a satisfactory solution to the difficulties of patentees and in what direction do you advocate further legislation ?

2.—What is your opinion as to the effect of the yearly fees which, in the event of renewal, are at present payable between the fifth and fourteenth years ? Should the British Patent Department be run so as to produce a profit for the Exchequer by the penalising of the inventor ? Should the Patent fees be reduced to the proportion of those charged by the American Patent Department

3.—What do you consider should be the constitution of the proposed searching staff, and how far should the search extend ? Do you consider that the examining staff to carry out the provisions of the New Patent Act should be supervised by a council of practical and acknowledged experts, selected by the Government ?

4.—How many years do you consider patents should run ? Do you think seventeen years' effective duration without further taxation, as in America, an equitable arrangement ?

5.—Have you encountered any instances in which our existing patent regulations have strangled an invention ?

6.—Do you consider that the term of a patent life should be proportionate to the importance of the invention, and to the time and money expended in its commercial perfection ?

7.—Is it your opinion that, when challenged, the inventor should be required, at a certain period of, say, any time after four years from the date of application, by affidavit, to prove that he, the inventor, has done his utmost to secure the commerical working of his invention ?

8.—Do you think it advisable that the Patent Department should offer prizes for the encouragement of the inventor ?

9.—Do you consider that the life of a patent should date from the time when it is commercially perfected, but limited to a period of seven years ?

10.—Should a foreigner who has patented an article in England, be allowed to import the article, manufactured abroad, into England, unless he can prove that he has attempted to secure the manufacture on fair terms in this country ?

11.—Should there be a council appointed by the Patent Office Department to determine rates of royalty, and licenses, and take into consideration the time and money risk involved in protecting an invention in order to fix the term of years to be allowed the inventor in which to secure a fair recompense ?

12.—Should patent cases be tested before a special tribunal of technical and legally trained experts, instead of the Judges with little or no knowledge of practical science ?

82, Victoria Street,
London, S.W.

To the Editor of PAGE'S WEEKLY.

DEAR SIR,—In answering the questions you ask me, I will take them in the same order :—

1. I think the search under the new Act will be of benefit to patentees. It will not help the highly

skilled inventor much, because he knows all that has gone before; but even he may have overlooked some abortive specification which, but for the official examination, might invalidate his patent. For the general run of inventors, it will be a great advantage. One drawback is that a great deal of time, and, therefore, money, will be spent in searches relating to perfectly useless inventions.

2. Certainly the Patent Office should not hand a balance to the Exchequer. This is taxing the inventor, and is only tolerated because inventors do not belong to either political party, and, therefore, have no way of making their complaints felt. The only good of renewal fees is that they prevent the ground being cumbered by useless patents, which, being in force, prevent the further progress of other inventors; as if a subsequent inventor succeeds in making progress, the owner of the idle patent comes down upon him. It might be possible to make a patent lapse if reasonable steps are not taken to work it in one country within reasonable time. This would be a difficult rule to apply.

3. I consider the present examiners the right people. They have always done their work excellently, and a "council of practical and acknowledged experts" would be apt to consist of publicists or people with a reputation among laymen, and no real knowledge. The genuine experts are rivals of the patentees. A Government selection would be almost certain to include all the wrong men.

4. Seventeen years is too long for most small inventions, and too short for large improvements. I think ten years would be better, with means of extending if the invention has not paid; but the proceedings for extension should be much less cumbrous and expensive than appeals to the Privy Council; and prolongations should be made as a matter of right, not as a concession to the inventor, and should only be refused on substantial grounds.

5. I have met no cases of inventions strangled by the present law. The present law, is, oddly enough, founded on common-sense, perhaps because it is largely judge-made.

6. I think an invention of a fundamental character, which demands many years to perfect, should have a longer term; but I do not think that the terms should be settled at the time of application. That is why I advocate the Prolongation Scheme, No. 4.

7. I think some method of preventing fishing patents would be of great value; but it is exceedingly difficult to devise any method that would work. There are many difficulties in determining whether a patent has been fairly pushed or not. Generally, the inventor has several alternative methods and improvements. Great difficulties would occur in dealing with foreign patents in this way. I fear the prevention of fishing patents is impossible.

8. Certainly, the Patent Department should not offer prizes. The existing prizes are quite sufficient to entice far too many men to their ruin. The inventor's real difficulties are financial; and he comes into them after he has made his invention.

9. Making the life of a patent begin at the date of perfection is impossible. There is no way to settle such a date; and it would allow people to keep half-baked inventions until others had worked out the details, and to pounce on the industry. Properly speaking, no one should apply for a patent till his invention is worked out.

10. I think a foreigner should be allowed to send goods into this country without any attempt to manufacture here; and that we should have the same privileges abroad.

11. If compulsory licenses are to be granted, the terms might be settled by the Patent Office people for sums up to a certain value, with a higher tribunal for more important cases.

12. A tribunal of "specially trained experts" for treating patent cases would be hopeless. If the experts were appointed by Government there would be a collection of retired soldiers, university professors, and advertising "scientists." The only genuine experts are almost certain to be the patentee's trade rivals. The non technical judge is bad; but he is willing to learn; while the expert would think he knew all about the matter, and would refuse to be taught. The judge must be absolutely unconnected with the industry; he must have an open mind, be legally trained, have ability to see through sophistry, and be unaffected by prejudice; and it would be a further advantage for him to have technical knowledge too, without thinking he knows all about things of that kind.

Litigants can have technical assessors on the Bench now for the asking; but they do not seem to like the idea.

It is a great pity that small cases involving small sums of money cannot be tried in a small way without going to the High Court. The present system of procedure is anything but perfect in cases involving hundreds of thousands; it is preposterous applied to small patents.

Yours faithfully,

JAMES SWINBURNE.

Salford Ironworks,
Manchester.

To the Editor of PAGE'S WEEKLY.

DEAR SIR,—In response to the request contained in your letter, and without entering particularly into all the points raised in your memorandum which accompanied it, I may say that the Patents Act of 1902, the principal clauses of which come into force on January 1st next, effects some improvement as far as it goes, but it might with advantage go further.

The newly instituted search by the Patent Office examiners as to novelty, restricted as it is, may effect some saving to the pockets of applicants by serving to bring to their notice anticipations of their inventions, would have been a much more valuable provision if it had taken account of the whole range of published knowledge of the art concerned, as is the case in the United States of America and in Germany.

The least satisfactory part, however, is that relating to the working of patents. The provision that a person, who considers that the requirements of the public are not met, may apply to the Board of Trade for a compulsory license, with the possibility of an appeal to the Judicial Committee of the Privy Council, entails a lengthy and costly procedure; and it would be far preferable that the working of a patented invention should follow automatically, as is the case in the majority of European States. Such a requirement would be merely equitable to the British inventor, who at present is handicapped as regard his foreign competitors, by the fact that he must work his invention patented in a foreign country, while no such obligation is imposed on the foreign inventor who secures a British patent.

The life of a patent might reasonably be extended to seventeen years, but the duration should be uniform irrespective of the importance of the invention. The present schedule of fees does not appear unreasonable, especially bearing in mind that after the initial costs of application have been paid, the patentee has three years in which to develop his invention commercially before he is called upon to pay any further Government fee.

Yours faithfully,
EDWARD HOPKINSON.

17, Victoria Street,
Westminster.

To the Editor of PAGE'S WEEKLY.

DEAR SIR,—Being neither an inventor nor a patent agent, I do not feel qualified to offer an opinion upon eleven out of the twelve questions you were good enough to send me, with a view of eliciting my opinion on the points involved in them.

With regard to question 12, however, having had a fair amount of experience in preparing and giving technical evidence in patent cases, I am of opinion that such cases should be tried before a judge, assisted by an assessor who should be thoroughly qualified to act as such by training and experience in either the profession, business, industry, or trade involved in the case to be tried. There should be no difficulty in obtaining competent assessors in each of the occupations indicated.

Yours faithfully,
PERRY F. NURSEY, C.E.

28, New Bridge Street,
London, E.C.

To the Editor of PAGE'S WEEKLY.

DEAR SIR,—Replying to yours on the subject of the British Patent Laws, we think that this country under the new law coming into force in 1905 will have a better law than any other country we know of, except in the matter of the Government fees which are undoubtedly too high.

The writer happened to be present at the meeting at which Mr. Thwaite's paper, as mentioned in your current number, was read, and the feeling of the meeting, which included such representative inventors as Sir Hiram Maxim and Sir Alexander Siemens, was in favour of the British system as opposed to the German and American systems.

As to the new Act, it is certainly an improvement on the old laws, but we think it is wrong in reducing the period of the Provisional Protection, and might very well have extended the duration of the patent to seventeen years.

Where we think the law could be improved is by providing a less expensive means of litigation in questions of infringement or revocation. At present a poor inventor, with a meritorious patent, is powerless against a large concern, who may and do presume on their position to infringe such patents; a tribunal of technical experts would probably be of considerable advantage in this respect, and might well consider also the question of extension of the duration of a meritorious patent on which large sums of money have been spent without obtaining an adequate return.

Yours faithfully,
PAGE AND ROWLINSON.

24, Southampton Buildings,
Chancery Lane,
London, W.C.

To the Editor of PAGE'S WEEKLY.

The questions raised in your letter of the 18th inst. can hardly be answered properly in a short letter, but I will endeavour to state my views as concisely as possible.

1. I consider that the new Act will introduce a system far in advance on that of any other country. The two principal grounds on which I based my opinion are that no power of refusal for alleged want of novelty is given to the examiners, and that the public is informed of the exact extent of the search. I send herewith a copy of the Engineer of July 1st containing an article elaborating these points. My views are in entire agreement with this article. I consider that no radical change in the Patent Law is desirable, but that improvement is needed in many points of detail, perhaps the most important being that it should be possible for an assignee of an invention to obtain a patent.

2. I think that renewal fees are desirable as they tend to clear the ground of patents for useless and unsuccessful inventions. I am strongly of opinion, however, that the Patent Office ought not to produce a profit; I regard this as the worst possible form of taxation.

3. I think the searching staff should be composed of men of good general scientific and mechanical education. I think that "a council of practical and acknowledged experts" would be most objectionable, such men are generally prejudiced in favour of existing methods, and see only the difficulties and not the possibilities of anything new; almost every great invention has at first been laughed to scorn by the experts.

I think that the search should be as complete as possible provided always that the public is informed of exactly what is done and what is left undone. I consider that a cursory and imperfect search over an indefinite field, such as is made in the United States and Germany is very objectionable.

4. I think, on the whole, that seventeen years would be a fair term for patents.

5. No.

6. In my opinion it would be most undesirable to have patents of different terms, according to the importance of the invention. No one, and certainly no public authority, is competent to judge of the importance of an invention until after it has been in use for many years. A large expenditure of time and money in perfecting the invention may be caused not by its importance but by the stupidity of its owners.

7. I am opposed to compulsory working in any form, because any requirement as to working has the effect of throwing doubt on every patent, whereas it is necessary that the patent should be secure in order to obtain the necessary capital for pushing the invention. My reasons are set out at greater length in speeches made by me at the Society of Arts on April 26th, 1891, and at the Board of Trade on March 20th, 1902. I enclose reports, and I also call attention to the remarks of other speakers, especially of the Lord Chief Justice at the former meeting.

8. No.

9. I do not understand what is meant by this question; an invention cannot be "commercially perfected" without being published, and if, therefore, the expression "life of a patent should date from the time when it is commercially "perfected" means that protection should not commence till that time, then every patent would be invalid. If, on the other hand, it is meant that the invention should be protected, but that the inventor should have no power of sueing for infringement until "the life of the patent" had commenced then the effect would be that an inventor could prevent others from using his invention for ever by not "commercially perfecting" the invention, because no one else would dare to expend time and money in so doing with the full knowledge that the inventor could at any time obtain the patent and thereby prevent him from continuing to work.

10. The importation into England of patented articles made abroad could only be forbidden if this country seceded from the International Union, for such a provision is contrary to the terms of Article 5 of the International Convention. In view of the great benefits we obtain from this Convention I think it would be most unwise to secede from the Union.

11. I think this suggestion is absolutely impracticable.

12. In my opinion it is very desirable that patent cases should be tried before "technical and legally trained experts," but it would be by no means easy to find persons possessing such qualifications; a judicial mind is quite as necessary as technical knowledge.

Yours faithfully,
EDWARD CARPMAEL, B.A. Cantab,
Assoc.Inst.C.E.

Owing to pressure upon our space, a number of interesting letters on this question are unavoidably held over. The discussion will, however, be continued in the following issue, and in the meantime we shall be pleased to receive the opinions of other readers who are specially interested.

OUR WEEKLY BIOGRAPHY.

SIR JOSEPH WILSON SWAN, M.A., D.Sc., F R.S.

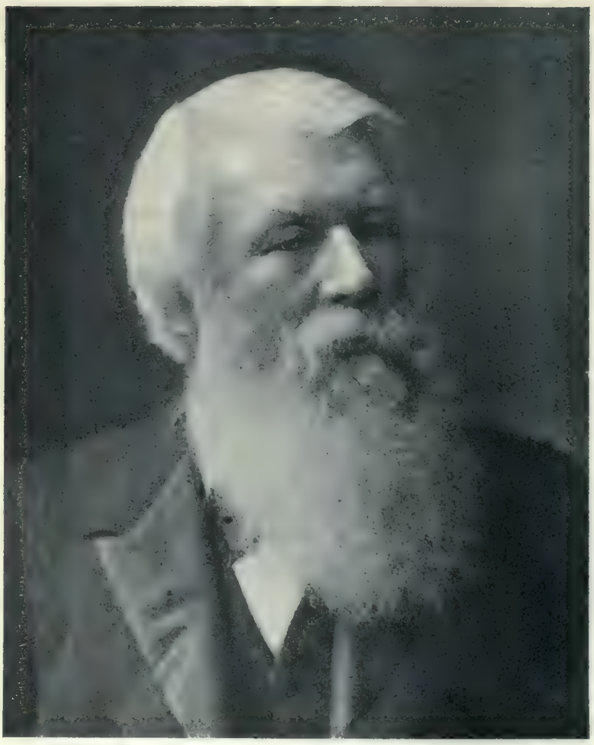
SIR JOSEPH WILSON SWAN, the inclusion of whose name in the recent list of the King's birthday honours occasioned wide-spread satisfaction, was born at Sunderland on October 31st, 1828. His principal school was that of Dr. John Wood, at Hendon Lodge, and later at Hylton Castle. Soon after leaving school he was apprenticed to a firm of chemists in Sunderland, and on their death, before the full expiry of the term for which he was bound, he joined his future brother-in-law and partner, Mr. John Mawson, who was established as a chemist in Newcastle.

Here he found himself completely in his element, and it was not long ere, through his influence, the scope of Mr. Mawson's business was greatly enlarged, and its character altered, by the addition of the manufacture of chemicals and scientific apparatus. When in 1851 Mr. Scott Archer published his discovery of the collodion process, Mr. Swan was already prepared to follow up that great advance. The most essential and critical element in Archer's process was gun-cotton, and the preparation of this material had been to Mr. Swan a familiar art from the moment of its discovery. Thus the manufacture of collodion was begun, and with such success that, to this day, the manufacture of Mawson's collodion continues on the basis then laid. In 1860 Mr. Swan entered into partnership with Mr. Mawson, and the firm of Mawson and Swan was established. Mr. Swan at this time also devised and patented modifications of the process known as the "Woodbury" type, whereby an electrotype of a granular carbon print was adapted to the ordinary process of copper-plate printing.

An explosion of nitro-glycerine on Newcastle Town Moor in 1867 caused the death of Mr. Mawson, and necessitated his partner taking over the actual management of the business. During the next few years he found but little leisure for scientific pursuits, but when later on the business was subdivided, he was relieved of much of the responsibility of management. He was thus enabled to resume his scientific researches.

One of the incidental results of the working out of the "carbon process" was the elucidation by Mr. Swan of the nature of the chemical changes which underlie that process, and the observation of the indurating effect of the salts of chromic oxide on gelatine. As a consequence of this observation. Mr. Swan proposed the application of the principle of this reaction to the leather-making trades. Chrome tanning, now an established industry, originated with this discovery. In 1877 Mr. Swan entered upon an experimental investigation with a view to the improvement of the gelatino-bromide process, and he so far succeeded in this object, that in the latter part of the year his firm were supplying dry plates, which for the first time truly rivalled collodion in sensitiveness and in the general character of the image produced. At an early stage of this new manufacture, he was led to examine into the cause of the varying sensitiveness of gelatino-bromide plates, and as the result of a crucial experiment a discovery was made which led to an immediate and great increase in the sensitiveness of the plates produced by his firm. Bromide printing paper, now in universal use, as a means of exceedingly rapid photographic printing by artificial light, was first proposed and patented by Mr. Swan in 1879.

Early in his career Mr. Swan had devoted a portion of the time at his disposal to electrical experiments and to the construction of electrical apparatus. There was always associated



SIR JOSEPH WILSON SWAN, M.A., D.SC., F.R.S.

with the performance of these experiments the working out of some new idea, or the attainment of some useful end. One of these persistently followed aims was the improvement of the means of producing electric light.

From the time when, in the year 1845, he had first seen platino-iridium wire made incandescent by Staite, until he finally triumphed over the physical difficulties of the problem of a practical incandescent electric lamp with a carbon filament, Mr. Swan neglected no opportunities for the realisation of the task to which he had applied himself. As early as 1860 he had taken a great step in advance, by finding the means of producing slender filaments of carbon possessing the requisite strength and elasticity, and also a sufficient degree of conductivity to admit of employment as the incandescing material of an electric lamp.

By carbonising paper strips packed in charcoal powder in a potter's kiln, the inventor had advanced so far that little more was needed than the mounting of the filaments in a vacuum of sufficient perfection to protect them from atmospheric chemical erosion during incandescence. The best vacuum obtainable by the ordinary chemical air-pump was tried with sufficient success to encourage the expectation that, when a better vacuum could be produced the incandescent carbon would endure.

Between 1870 and 1880 several things happened, which incited him to increased activity in the endeavour to obtain a solution of the problem of a simple and efficient electric lamp, with carbon filament.

At this time he became acquainted with Mr. C. H. Stearn, an ardent experimentalist and expert in the manipulation of the Sprengel pump, and sought his assistance, and for several years he was collaborator with Mr. Swan in the evolutionary period of the incandescent lamp.

What was done by Mr. Swan was to give practical effect to a long and widely entertained idea, by devising and constructing the form of incandescent electric lamp that is now universal—viz., a highly exhausted glass bulb with two hermetically sealed-in wires entering the bulb, and supporting between their inward ends a thin carbon conductor. He exhibited a lamp of this type at his lecture in Newcastle in the month of February, 1879, Sir William Armstrong being in the chair, and also a few days later at Gateshead.

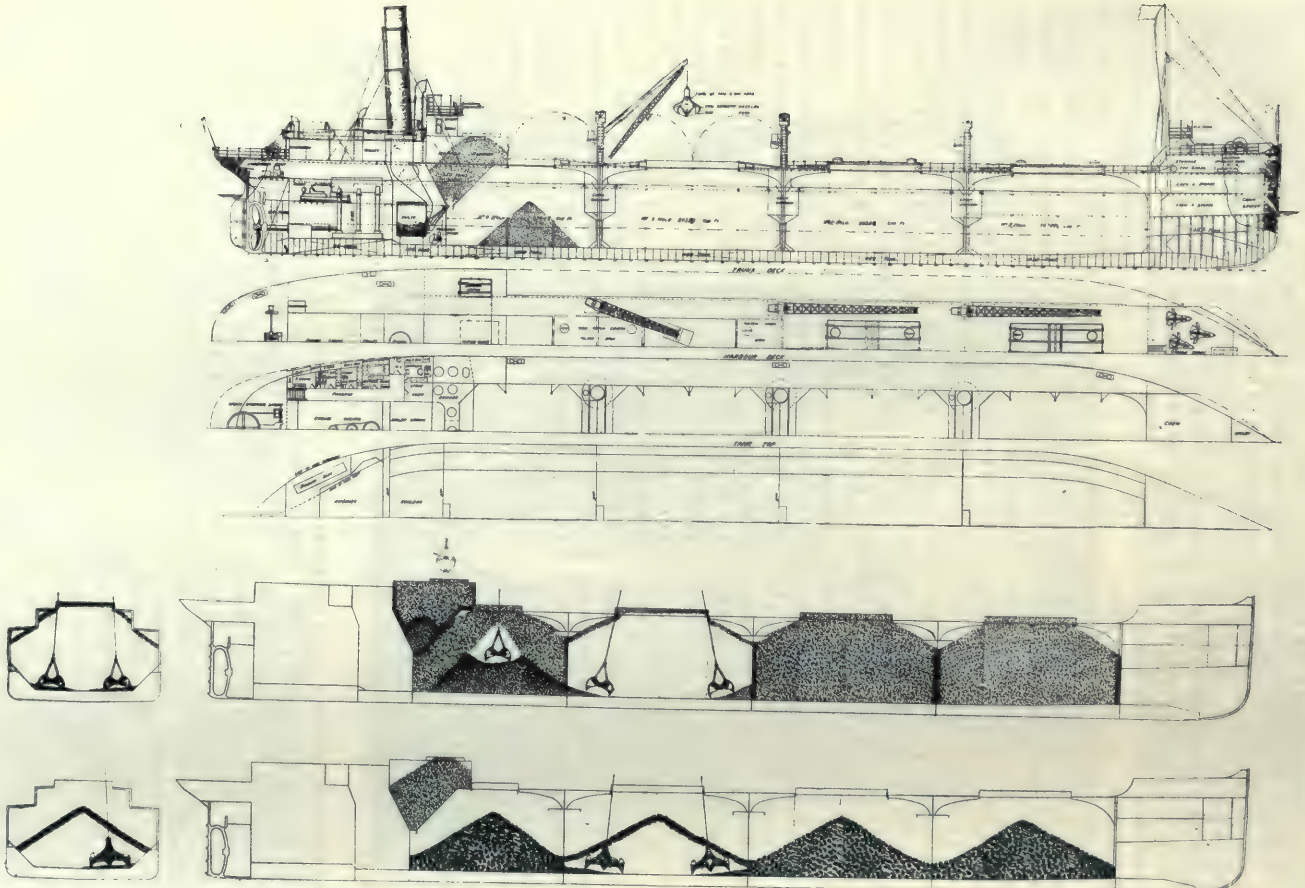
The first large public exhibition of lamps of this character took place on October 20th, 1880, at the lecture-room of the Literary and Philosophical Society of Newcastle. This was probably the first occasion of the general lighting of a public room by incandescent lamps.

In his earlier experiments the carbon filament had been made from paper; but a perfectly satisfactory result was not obtained until he made use of carbonised parchmentised cotton-thread, and the experimental stage of the incandescent lamp can hardly be said to have passed until the inventor had produced the carbon filament from that material.

At the outset of the manufacture of the incandescent lamp many difficulties of detail had to be overcome, and much time was spent over many years in efforts to overcome them. Means were sought to render the lamp more efficient in respect of the amount of light yielded for a given expenditure of energy, and, later to adapt it to the distribution of electricity at higher pressure. One of the most valuable of the results of these efforts was the discovery of the means of producing a perfectly homogeneous and uniform filament from collodion or cellulose solution, by the discharge of one or other of these solutions from a jet into a coagulating fluid. This principle of filament making by squirting was worked out, and important results followed its adoption—among these the production of much finer and more uniform filaments, and the consequent increase of economy of electric lighting. The Swan filament-making process with either collodion or a solution of cellulose has become universal, and with its adoption there has been attained the power of producing lamps of low candle power at the high voltages necessary for the most economical distribution of electricity by public lighting.

At the Inventions Exhibition of 1885, Mr. Swan exhibited the general principle of the process of artificial filament production, and under the name of "artificial silk," several examples of the product were shown, both as thread and in the form of a fabric.

Sir Joseph Swan was elected a Fellow of the Royal Society in 1894. He has received the honorary degrees of M.A. and D.Sc. of the University of Durham, and on the close of the Electrical Exposition of Paris, 1881, he received the decoration of Chevalier of the Legion of Honour. He is an honorary member of the Institution of Electrical Engineers, and was President of that Institution for the years 1898 and 1899, and of the Society of Chemical Industry for 1900 and 1901.



MR. HENRY BURRELL'S NEW TYPE OF "STRAIGHT-BACK" COAL AND ORE CARRIER WITH ELECTRICAL EQUIPMENT.

DIMENSIONS.

Length	360 ft. 0 in.
Breadth moulded	52 ft. 0 in.
Depth moulded	24 ft. 6 in.
Load draught	20 ft. 0 in.
Deadweight carrying capacity	6 tons 10 cwts.
Speed	10 knots.

CAPACITIES ON HOLDS.

Hold No. 1—Hatch,	1,280 cub. ft.		
Hold,	75,500 ,,	76,780 cub. ft.	
Hold No. 2—Hatch,	1,280 ,,		
Hold,	79,100 ,,	80,380 ,,	
Hold No. 3—Hatch,	1,280 cub. ft.		
Hold,	79,100 ,,	80,380 cub. ft.	
Hold No. 4—Hatch,	640 ,,		
Hold,	58,800 ,,	59,440 ,,	

Total Capacity ... ... 296,980 cub. ft.

WORKING CAPACITIES.

Automatic Trimming ... 2,000 tons per hour. | Mechanical Discharge ... 600 tons per hour.

NEW TYPE OF "STRAIGHT-BACK" STEAMER.

Designed to Work in Conjunction with Large Capacity Wagons.

We reproduce herewith detailed views, stowage plans and particulars of a new type of steamer, which has been designed to play an important part in the coal and iron industries. The drawings represent Type C. "Straight-back" 360 ft. by 52 ft. by 24 ft. 6 in. Md. drawing 20 ft.; and steaming 10 knots, with 6,100 tons d.w. These steamers have been designed to meet various requirements; type A, 13,000 tons d.w.; B, 9,200 tons d.w.; C, 6,100 tons d.w.; and D, 3,500 tons d.w. They are equipped with 10, 8, 6, and 4 electric deck cranes respectively, the deliveries being 1,000, 800, 600, and 400 tons per hour in coal and ore, with a port and starboard delivery.

The lack of large capacity railway wagons has hitherto caused the shipowner infinite loss by delays, while imposing upon the iron-masters a comparatively high freight rate, and consequently a stiffer cost for his ore supplies, as compared with trans-Atlantic furnacemen. It is claimed that this type of steamer can obviate these defects, as she has the ability to discharge her cargo independently of manual labour, and with great rapidity, direct into the larger trucks now being provided. The other feature of the steamer is her ability to burn a lower grade of coal without increasing the consumption, while obviating the use of trimmers and firemen. These two desiderata are dependent upon the construction of the steamer, an electric deck-crane equipment, an iron hatch cover, and an automatic hopper bunker, unitedly constituting the new type.

The water-tight steel hatch covers provide an entire steel deck surface, while obviating the use of tarpaulins, bars and detached wedges, greater immersion being assigned, as the hatch spaces are valued in reserve buoyancy. The continuous trunk and sloping bilges introduced provide automatic trimming in loading and discharging homogeneous cargoes, while the additional water-ballast capacity in the bilge tanks enables the steamer to proceed on a winter voyage in seaworthy trim, leaving hold spaces unbroken. The hopper bunker is within the arc of the cranes, and can thus be replenished by a grab from the after-hold, when required, thus obviating the employment of trimmers.

The electric deck cranes, to operate the grab and effect mechanical discharge, with their considerable outreach, command a large hatch area, while enabling the operator at the elevated crane platform to regulate the action of the excavator when the residue of the cargo comes to be dealt with. It is released into lighters or wagons at a distance up to 32 ft. from the ship's side with great rapidity, the cost being payments to the crew acting as cranemen.

The engines are placed aft, affording free hold spaces. The mechanical stoking applied to the hopper bunker reduces the boiler room staff to four men, two on six hours' watches; moreover, good stoking is kept up in the worst weather. By these facilities the efficiency of the steamer is greatly increased, and it is hoped that the reduction of freights commensurate to phenomenally low costs, may lead to the development of over-sea coal markets, more especially where French or German coal comes into keen competition with British coal. It is claimed that the steamer on a short run can do 20 to 25 per cent. more work, while obviating the labourage, which is 9d. to 1s. per ton, and carrying twice the load of its competitors.

For particulars given above, and for illustration, we are indebted to the inventor and projector, Mr. Henry Burrell, of 73, Robertson Street, Glasgow.

PORTABLE STEAM ENGINES OF TO-DAY.

BY

J. C. R. ADAMS.

The following article is continued from No. 9. The previous articles of the series, devoted to a theoretical and practical consideration of single-cylinder locomobiles, will be found in the July, August, and September issues. PAGE'S WEEKLY was commenced on October 14, 1904.—ED.

VI.

MESSRS. DAVEY PAXMAN AND CO., LTD., of Colchester, build their compound portable engines upon somewhat different lines from those we have hitherto examined, carrying the detachable principle still further than any of their competitors.

Instead of bolting their cylinder and crankshaft bearings directly to flanged steel seatings riveted to the boiler, the complete engine is fully erected upon a steel girder frame, which, in its turn, is secured to the boiler brackets.

Of course, in this case, the steel tie-rods are omitted, the stresses being taken by the girder frame. Messrs. Paxman's compound portable engine has a splendid record, as we shall presently see, but to the reviewer nothing is sacred, and I must say that, structurally speaking, I consider the straight-line principle embodied in the simple tie-rod, carried on a level with the axis of the engine, preferable to

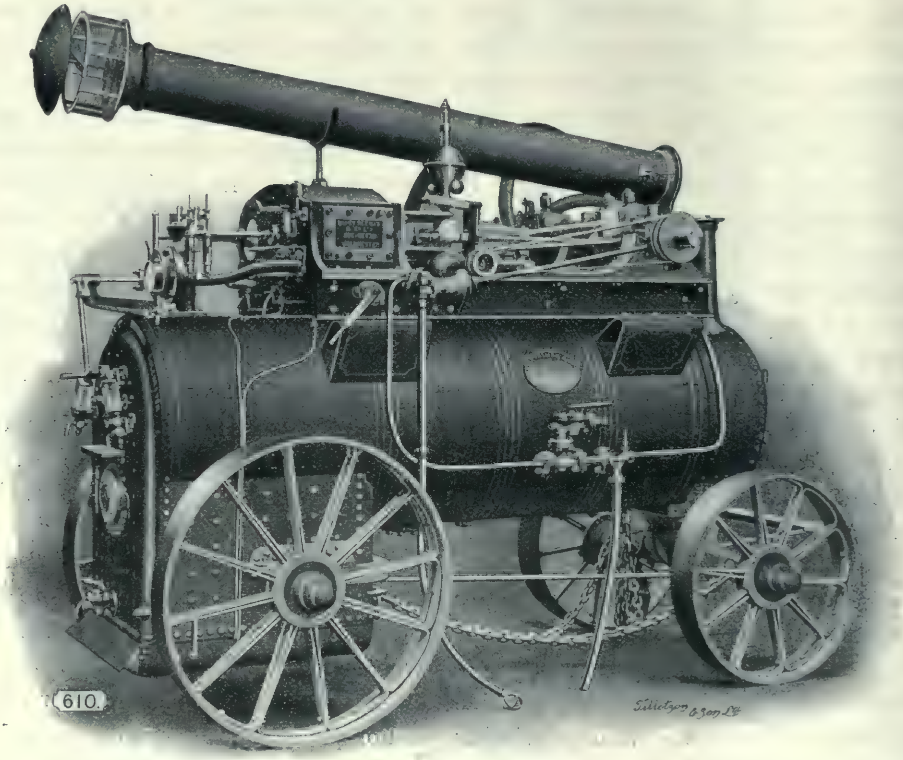
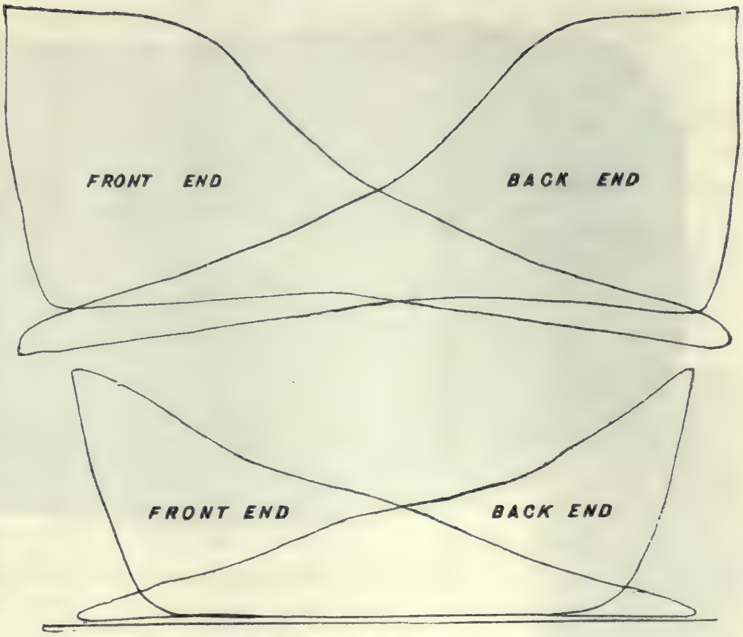


FIG. 10. MESSRS. DAVEY PAXMAN AND CO.'S (LTD.) NEW COMPOUND PORTABLE STEAM ENGINE ON ROLLED GIRDER FRAME.

the heavier and more elaborate girder frame, several inches below the centre line. However, as in neither case is there likely to be any yielding or longitudinal weakness, we may treat this as a matter of individual opinion, and pass on to other matters. The crank-shaft is not machined from a solid steel forging, as is usual in this class of engine, but is bent from a round steel bar. Probably the bent crank-shaft is strong enough, but I must confess to a liking for the bright steel throws of the slab pattern of crank-shaft. The engine would be none the worse, also, if a centre bearing were provided.



Scale $\frac{1}{32}$ Low Pressure Cylinder.

FIG. 11. DIAGRAMS FROM MESSRS. DAVEY, PAXMAN AND CO.'S VALVE GEAR.

The automatic expansion gear, which I am glad to see is provided as a matter of course, is on the well-known Paxman system, two eccentrics being employed to actuate the expansion valve (which, by the way, does not slide directly on the back of the main valve but upon a ported plate sandwiched between the two valves). The rods from these two eccentrics are coupled to a link exactly as in the Stephenson reversing gear. The governor raises and lowers this link as the load varies the valve rod partaking more or less of the motion of either eccentric rod according to the height of the governor sleeve. The position and travel of the eccentric actuating the bottom of the link are such as to give a very early cut-off ; the movement of the top of the link, derived from the other eccentric giving the maximum cut-off point. Diagrams taken from this valve gear are shown in fig. 11.

The governor is of the deadweight type, with friction-rollers interposed between the arms and the weight, thus greatly increasing the sensitiveness of its movement.

The Royal Agricultural Society of England, in July, 1887, awarded their prize of £200 to Messrs. Davey, Paxman and Co., Ltd., for their 8-h.p. (nominal) compound portable engine, on its recorded consumption of only 1·85 lb. of coal per b.h.p. per hour ; beating their own 8-h.p. single-cylinder engine, which consumed 2·6 lb. per b.h.p. per hour, almost exactly in the proportion of 25 to 35, thus confirming the comparative figures given in the earlier part of the present article, from independent sources, as the measure of the relative economy of the compound and the ordinary high-pressure portable engines.

Horse-Power.		Cylinder.			Revs.	Total weight.
Nominal.	Effective.	H.P.	L.P.	Stroke.	per min.	cwt.
8	22	5½	9	14	155	92
10	27	6½	10½	14	155	111
12	33	7	11¼	14	155	132
16	44	8	13	14	155	176
20	55	9	14½	16	135	205
25	68	10	16	18	120	255
30	82	11	17½	18	120	296

The ratio between the cylinders averages 2·6 to 1, and the working pressure is 140 lb.

(*To be continued.*)

FIG. 1. A PIECE OF RAW PARA RUBBER.

GUTTA GENTZSCH: A NEW INSULATING MATERIAL.

(BY OUR ELECTRICAL CORRESPONDENT.)

In Page's Magazine for August, 1902, we briefly referred to an insulating substance which was being introduced into this country by the New Gutta Percha Company, Ltd. During the intervening period, tests have been undertaken in order to corroborate the experience gained by well-known electricians in Germany, and to show that the material, though primarily intended by the inventor as a substitute for gutta percha can, by a slight modification of process, be economically adapted to the insulation of wires and cables for all purposes to which vulcanised india-rubber cables have been, and are being, so largely used.

THE CHARACTERISTICS OF PURE GUTTA PERCHA.

A few words will perhaps not be out of place concerning the difference between gutta percha, natural india-rubber, and vulcanised india-rubber. Pure gutta percha is colourless, and in sufficiently thin sections is transparent. At the ordinary temperature it is tough, but not very elastic. As regards elasticity, it resembles soft leather. At about a temperature of 76 deg. F. its pliability increases and at about 100 deg. F. reaches what is termed the softening point. At a higher temperature, say, about 160 deg. F., it becomes so plastic that it can be moulded into any shape, which is retained when the material is brought back to the ordinary temperature.

Gutta percha is not affected by cold, even at a temperature several degrees below zero. It is also practically impervious to water, only a small quantity being absorbed by the exterior pores after prolonged immersion. It is a bad conductor of heat, and a good electric insulator. As regards this latter quality, it may be said that no other plastic material is even approximately equal to it.

Gutta percha is very sensitive to the oxidising influence of the atmosphere, and particularly to the effect of sunlight, which causes rapid deterioration of the material and causes it to become brittle and pulverulent.

NATURAL INDIA-RUBBER.

Natural rubber (crude non-vulcanised) begins to soften at about 90 deg. F. and at about 125 deg. becomes sticky, on the other hand at about 50 deg. F. it becomes stiff and hard, and at freezing point will break off when bent backward and forward repeatedly. Exposure to sunlight and air, especially in a hot damp atmosphere, causes the rubber to oxidise very quickly, and it then degenerates into a pitch-like mass.

VULCANISED INDIA-RUBBER

Vulcanised india-rubber is produced by treating natural rubber with sulphur and exposing it to the action of heat. After treatment by this process the rubber ceases to be sticky and the range of elasticity is considerably increased. Vulcanised india-rubber does not lose its elastic or other properties even when immersed in boiling water, and on the other hand it is far less sensitive to the action of the cold. It will be at once seen that by means of vulcanisation natural rubber is transformed into a commercial product which, while retaining the valuable properties of rubber, ceases to exhibit the disadvantageous characteristics mentioned above.

Gutta percha, although a vegetable product analogous to rubber, is an entirely different substance, the only similarity between them being that both originate in the milky juice of certain trees, and that carbon and hydrogen are present in their chief constituent in somewhat similar proportions. It is a little strange that two substances so different in their properties are still referred to by the great majority of people as though they were different kinds of the same material.

THE DIMINISHING SUPPLY OF GUTTA PERCHA.

Genuine gutta percha is obtainable commercially in only one portion of the globe, namely, in portions of the Malay Peninsula and the Island of Borneo. Owing to the system adopted by the natives in collecting the juice of the gutta-percha tree, the source of supply is rapidly diminishing, with the result that gutta percha is becoming scarcer, whereas the cultivation of india-rubber is possible in many parts of the tropics and is increasing year by year.

A SUBSTITUTE.

The great commercial value of a really efficient substitute for gutta percha has been recognised for many years past and innumerable attempts have been made to imitate the natural gum without, however, resulting in the production of a material possessing the necessary physical and electrical properties.

The material invented for this purpose by Mr. Adolf Gentzsch of Vienna, and manufactured in England by the New Gutta Percha Company, Ltd., at Greenwich, is the result of many years of experiment and test. It is composed of india-rubber with which is incorporated a wax-like mass for the purpose of imparting to the mixture the physical and electrical characteristics of gutta percha, but no gutta percha whatsoever is used in the manufacture, and the ordinary filling material which enters

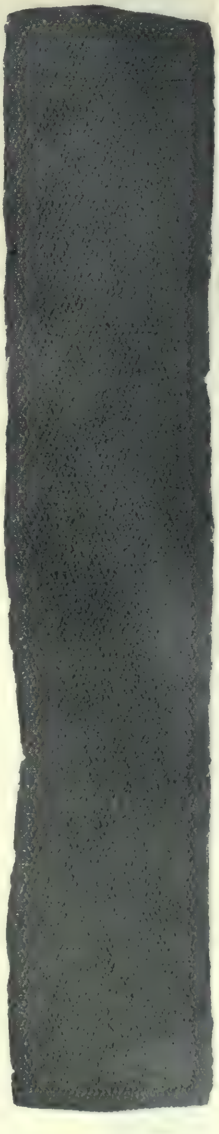


FIG. 2. APPEARANCE AFTER FIRST WASHING

FIG. 4. APPEARANCE OF FINISHED MATERIAL (GUTTA GENTZSCH).

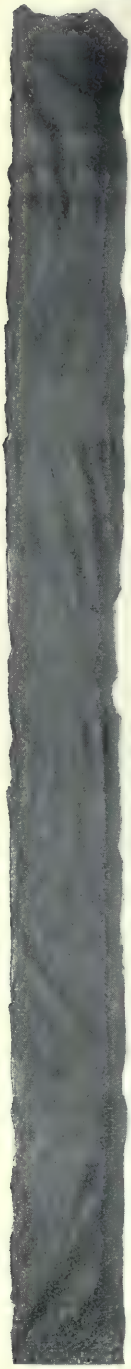


FIG. 3. APPEARANCE OF RUBBER IN SECOND STAGE.

into the usual rubber mixtures is entirely absent. The most scrupulous cleanliness has to be observed in all the processes in connection with the production of this material which is known to the German Patent Authorities and to the Postal authorities at Berlin as "Gutta Gentzsch."

Fig. 1 illustrates the appearance of the raw rubber as it is delivered to the Company. The rubber is first of all carefully washed in a special machine when it assumes the appearance shown in fig. 2. It then undergoes another process after which it appears as shown in fig. 3.

Fig. 4 illustrates the appearance of the finished material.

The wax-like substance, which is the sole ingredient with which the rubber is mixed, is carefully prepared and treated by a special process whereby the temperature of fusion is raised approximately to that of rubber, the consequence being that the finished product is a homogeneous mass which is not liable to segregation of the constituent parts by changes of temperature. Thus one of the chief disadvantages of all substitutes for gutta percha which have hitherto been placed upon the market is overcome.

THE SOFTENING-POINT OF GUTTA PERCHA.

A leading authority on the subject of gutta-percha and rubber substitutes, who has examined every gutta-percha substitute that has been produced within recent years, states that the temperature at which these substitutes soften is in every case lower than that of the natural gutta percha, which in itself is low enough, namely, about 100 deg. F. For the insulation of submarine telegraph cores the low softening temperature of real gutta percha is, of course, not so serious a matter when the cable is once laid, as it is extremely rare that the temperature of the sea—except quite near the shore—is anything like 90 deg. F. In the process of manufacture at the works, however, the low softening point of gutta percha sometimes constitutes a serious difficulty, particularly if the cable is manufactured during the summer months, and in all the principal cable works refrigerating plant has been installed in order to effect the necessary cooling of the water through which the core is drawn after the gutta percha has been applied, so as to reduce to a minimum the risk of decentralisation of the copper conductor on the winding-off drum due to the necessary tension required to draw the wire through the covering machine. For the insulation of wires and cables designed for such uses as those to which vulcanised india-rubber wires are put in the present day, gutta percha is absolutely out of the question, not only on account of the low softening point, but also because of its rapid deterioration in dry places, or when exposed to light and air. In fact it may be broadly stated that with the exception of mechanical goods the practical use of gutta percha as an insulator for wires is limited to the insulation of submarine telegraph and telephone cables, blast-fuse wires, wires for exploding submarine and other mines, and cognate purposes. As has been remarked before, the original intention of the inventor was to produce a substitute for gutta percha, and in this he may well claim to have been successful for reasons to which we will refer later, but a modification of the process whereby the material is rendered suitable for the insulation of land wires and cables, opens out a new and almost unlimited field of usefulness.

THE CHARACTERISTICS OF "GUTTA GENTZSCH."

We are informed by the New Gutta Percha Company that "Gutta Gentszch" possesses characteristics which render it superior to the natural gutta percha. The following constitute some of the leading features of this material:—

1. "Gutta Gentzsch" quality for quality is very much cheaper than gutta percha. 2. It is tougher at ordinary temperatures. 3. It only commences to soften at about 140 deg. F., whereas the softening point of real gutta percha is about 100 deg. F. 4. The resistance of "Gutta Gentzsch" to the influence of oxidation and to the effect of sunlight is remarkably great, whereas real gutta percha is very sensitive to the action of light, and rapidly deteriorates if exposed to the air. 5. "Gutta Gentzsch" is not affected by dryness, whereas it is well known that natural gutta percha does not stand well in dry places 6. It is equally unaffected by damp and wet. 7. It is practically unaffected by acids and alkalies.

As regards the modified form of "Gutta Gentzsch" before referred to, which is being used for the insulation of wires and cables for electric and power purposes, the Company claim for it the following advantages as compared with vulcanised rubber:—

1. It is cheaper than vulcanised india-rubber. 2. It is not adversely affected by damp, whereas it is well known that vulcanised india-rubber wires deteriorate in the presence of damp. 3. The specific gravity of "Gutta Gentzsch" is 1·05 as against 1·4 to 1·6-7, or even higher, of good qualities of vulcanising rubber compounds. Thus for the same insulating effect a pound of this material would cover a considerably greater length of wire than the vulcanising rubber compounds; so that wires insulated with "Gutta Gentzsch" are much lighter per foot run. 4. "Gutta Gentzsch" is a finished product, and is not submitted to any chemical or other process after it is applied to the wire, whereas in the case of ordinary rubber insulated wires the process of vulcanising in itself involves a considerable element of uncertainty.

It is well known that vulcanised india-rubber is apt to vary enormously in reliability and durability. The reason of this is well known to manufacturers, but it is not so clear to those not intimately acquainted with the manufacture of vulcanised india-rubber.

Vulcanisation is, at the best, of the nature of an interrupted process. It is a most difficult in fact, critical operation, the satisfactory "cure" being absolutely dependent upon the skill and experience of the operator. No hard and fast rules can be laid down as to the nature of the process, and while every manufacturer maintains that by his process—which is most jealously guarded and kept secret—he has solved the problem, it is admitted by independent scientific men that the nature of the vulcanisation process is still very little understood. The exposure of the rubber compound to the action of heat for even a small period of time in excess of, or short of, the exact duration required for proper vulcanisation, may result in evils the extent of which it is impossible to gauge at the moment, and which only make themselves felt after the lapse of time.

This is a very serious defect, because deterioration of the insulation of electric wires may be fraught with dangerous consequences, since as a general rule the wires are placed out of sight in more or less inaccessible positions and very frequently in close juxtaposition.

The essential principle in vulcanisation is the change in the physical characteristics of rubber which is effected by the action of sulphur under the influence of suitable conditions, heat being most usually employed. The conductor has to be tinned in order to prevent the deteriorating action of the sulphur on the copper. The constituents of the wax-like mass which is added to the rubber in "Gutta Gentzsch" are all chemically inert and stable products, so that the copper wire insulated with "Gutta Gentzsch" are not tinned unless specified.

TESTS OF CABLES INSULATED WITH "GUTTA GENTZSCH."

The Imperial Post Office of Germany, before deciding to occupy themselves seriously with the material on a practical scale, subjected "Gutta Gentzsch" to very severe tests in the Official Experimental Department, in collaboration with Messrs. Felten and Guilleaume of Mülheim. The results were so satisfactory that in the year 1901 the Imperial German Telegraph Board decided to commence laying down short lengths of submarine telegraph and telephone cables on their system as and when required. An official account of the behaviour of these cables is published in the "Archiv für Post and Telegraphie," for February, 1904, from which the following particulars are taken:—

"The electrical properties of 'Gutta Gentzsch' are similar to those of the natural gutta percha; mechanically, however, the artificial gutta percha is superior to the natural gutta percha, in so far as the artificial material can stand a temperature of 60 deg. C. (140 deg. F.), without becoming soft."

"An order was placed with Messrs. Felten and Guilleaume for a fourcore sea cable 8·7 kilometres in length, and this was laid in the year 1902 between the Mainland and the Island of Fahr. Each core consists of seven strands of copper wire 0·6 millimetres in diameter, which are covered with 'Gutta Gentzsch' to a diameter of 6 millimetres. The four cores are spirally laid up and wound round with tanned jute yarn and then protected by an armouring consisting of 14 iron wires of circular section and 5·3 millimetres diameter served with a double covering of compound. The finished diameter of the cable is about 36 millimetres, and the weight about 3,500 kilogrammes per kilometre. Each core had fo fulfil the following conditions—

"Conductor resistance 9·6 ohms per kilometre at 15 deg. C.

"Minimum insulation resistance 500 megohms per kilometre.

"Maximum value of capacity 0·15 microfarad per kilometre.

"The following table gives a list of 'Gutta Gentzsch' cables which have since been laid by the Imperial Post Office of Germany. The method of construction and the terms and conditions of delivery were the same as those for natural gutta-percha cables of similar type.

Description of cable.	Length	No. of cores.	No. of strands in each core.	Diameter of strand.	Conductor resistance, per km.	Insulation resistance, per km.	Capacity, per km.	Diameter of core.
	km.			mm.	ohm.	meg-ohm.	micro-farad.	mm.
Ihrhove-Weener	0·42	7	7	0·73	6·5	650	0·22	7·0
Norden-Nordeich..	5·00	4	7	0·66	7·0	500	0·24	5·2
Vinkelpolder-Nordeney	8·00	3	7	0·73	6·5	650	0·22	7·0
Do. do.	1·00	3	7	0·66	7·0	500	0·24	5·2
Cable across the River Weichsel	0·75	7	7	0·73	6·5	650	0·22	7·0
Cable across the River Ems:—								
(*a*) At Oberlangen	0·32	1	7	0·73	6·5	650	0.22	7·0
(*b*) At Halte	0·20	1	7	0·73	6·5	650	0·22	7·0

"The cost of these cables was, on the average, 35 per cent. less than that of ordinary gutta percha cables of the same size."

OTHER TESTS.

We are informed that Messrs. Felten and Guilleaume have had a cable insulated with this material to a radial thickness of 0·236 in., in daily use for more than 16 months under a pressure of 15,000 volts alternating, the pressure being kept on for 12 hours every day, and that no change whatever has taken place in the insulation during the whole of this period.

A length of submarine telegraph cable core (130 lb. copper, 130 lb. "Gutta Gentzsch" per statute mile), which was manufactured in November, 1902, has been under test in the laboratory of Mr. James Swinburne (past-President, Institute Electrical Engineers) since June, 1903. The inductive capacity was then 0·306 microfarads per mile, and has not altered since.

The following is the complete test:—

Date of Immersion, November 18th, 1902.

DATE.	Inductive capacity in microfarads, per mile.
November 18th, 1902	0·251
December 19th, 1902	0·268
January 20th, 1903...	0·283
February 18th, 1903	0·296
March 20th, 1903	0·299
April 20th, 1903	0·305
May 20th, 1903	0·306
August 29th, 1903	0.306
November 8th, 1903	0·305
August 16th, 1904	0·303
October 20th, 1904...	0·305

We are informed that in consequence of the success that has attended the use of cables insulated with "Gutta Gentzsch" by the German Post Office, an order has been placed with the Company by the British Admiralty for four trial lengths of "Gutta Gentzsch" cables.

We are indebted to the Directors of the Company for enabling our representative to inspect the works, and witness the entire process of manufacture, and also for the accompanying illustrations.

Launches and Trial Trips.

THE official trials of the new stern well bucket hopper dredger, *St. Giles*, constructed by Messrs. W. Simons and Co., Ltd., to the order of the Admiralty, have taken place on the Clyde. The trials achieved results considerably in excess of the contract requirements. The *St. Giles* is designed to cut her own flotation, and down to a depth of 55 ft. below water level.

An interesting launch which took place at Armstrong, Whitworth and Co.'s shipyard last week was that of the oil-tank steamer *Nerite*, which has been built for the Shell Transport and Trading Company.

The two new destroyers *Doon* and *Kale* were launched a few days ago from the Hebburn shipyards of Messrs Hawthorn, Leslie, and Co., Ltd. The vessels are of the *Derwent* or improved destroyer type, 220 ft. long, with machinery working at 350 revolutions and developing 7,000 i.h.p., and make five of this type which the Hebburn yard has turned out for our Navy. The engines for both vessels have been constructed at the St. Peter's Works of the firm, and will be immediately fitted on board.

The *Priam* and the *Atlantic*, which have also been built by Hawthorn, Leslie and Co., Ltd., have been undergoing their trials. The former, built for the Ocean Steamship Company, is distinguished by powerful cargo gear—there being 17 winches and 23 derricks, capable of lifting weights up to 30 tons, for the working of which an auxiliary boiler, 11 ft. diameter by 9 ft. 9 in. long, is provided, working at 180 lb. pressure. The machinery has been constructed by the North Eastern Marine Engineering Company Ltd., and is of the inverted direct-acting type.

The *Atlantic* has been built with large holds and hatches, with the view to the carriage and rapid handling of wood and grain cargoes. The machinery has been supplied by the North-Eastern Marine Engineering Company, Ltd., and consists of a set of triple-expansion engines, having cylinders 25 in., 40½ in., and 67 in. by 45 in. stroke, and three single-ended boilers, 13 ft. 6 in. by 11 ft. long, all working at a pressure of 180 lb.

The new steamer *Addah*, intended for the African service of Messrs. Elder, Dempster, and Co., has been launched from the yard of the Palmers Shipbuilding and Iron Company, Ltd., Jarrow-on-Tyne.

The *Claremont*, a large turret vessel, built to the order of the Horsley line, has been launched by Wm. Doxford and Sons, Ltd., of Pallion. Her dimensions are: Length 352 ft.; breadth, 40 ft.; depth, moulded, 26 ft.; deadweight carrying capacity, 6,300 tons.

The new American armoured cruiser *West Virginia* has attained an average speed of over 22 knots over a four hours' trial trip.

The first of a new type of submarine for the British Navy, to be known as the "B" class, has just been launched at Barrow from Vickers, Sons, and Maxim's naval construction works. Twelve of the "A" class have already been built, but the new type is larger, and embodies many improvements, particularly in the internal construction. The new submarine is 150 ft. long, and 63 ft. girth.*

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* See "Naval Notes."

ENGINEERING DEVELOPMENTS.

Portable Water-Distilling Plants for the Economical Production of Fresh Water.

THE increasing demand for a portable Water-Distilling Apparatus easily moved about and set to work, suitable for producing perfectly pure water for drinking and cooking purposes, particularly in those arid and tropical regions where undrinkable brine or other impure water supply exists, has induced the Mirrlees-Watson Company, Ltd., to manufacture distilling plants specially suited for this work.

The accompanying illustration shows their latest double-effect portable water-distilling plant, with boiler and pipe connections complete. This machine has an output of 65 gals. pure drinking water per hour—not including the condensed "boiler steam" or "drip" from first shell. The complete distilling apparatus, including pumps, boiler-feed tank, spares portable tool boxes, etc., is securely mounted on a strong carriage, constructed of light steel framing, and suitable for animal haulage.

The working of the apparatus is as follows: The impure feed-water (drawn from the condenser overflow) is pumped through a feed-heater, and is heated by the drip-water from shell of first vessel, on its way to the latter, where it passes through a series of tubes exposed on the outside to steam from the boiler. The steam rising from the impure water passes from the separator to the second shell where it heats the impure water contained in the tubes of the second vessel—this impure water being continuously discharged from the separator of the first vessel into tubes of the second, owing to the difference in pressure in the two vessels or effects. The steam from this last effect, along with the drip-water from the second shell, passes direct to the condenser, and is discharged as pure distilled water.

The drip-water—or "boiler steam condensed"—from the first shell, after passing through the feed heater, discharges into boiler-feed tank, and is pumped back into boiler. The local water is in this case assumed to be unfit to feed the boiler; but when the water is good enough for boiler-feed purposes, though unfit for drinking, the drip from the first shell is utilised for heating in the second shell, and goes to further increase the quantity of distilled water. When once the machine is "set" and working, with the steam in boiler kept at a steady pressure, the apparatus requires very little attention.

The steam boiler is of the portable "loco-tubular" type, and is suitable for a working pressure of 80 to 100 lb. per sq. in. It is constructed with an extra large fire-box, suitable for burning wood—donkey feed-pump, tank, and connecting pipes supplied, all as shown.

This type of apparatus has been designed for the use of prospecting and exploring parties, temporary hospitals, visiting and supplying fresh water to small mining stations up country, etc., etc.

This type of distiller is made in three different sizes—viz., 28, 47, and 65 gals. of pure distilled water per hour.

For large non-portable installations (200 gals. per hour and upwards) the firm construct a Six-Effect Apparatus, which has been brought to such perfection that no less than 44 lb. of gained pure water, in addition to a full supply of boiler-feed water have been obtained by the combustion of 1 lb. of net fuel. In districts where the local water is suitable for boiler-feeding purposes—though unfit for drinking—the drip-water from the first shell, instead of going to feed the boiler is passed through the multiple-effect system, and goes to increase the output of the machine.

The Proposed Higher Technical College for London.

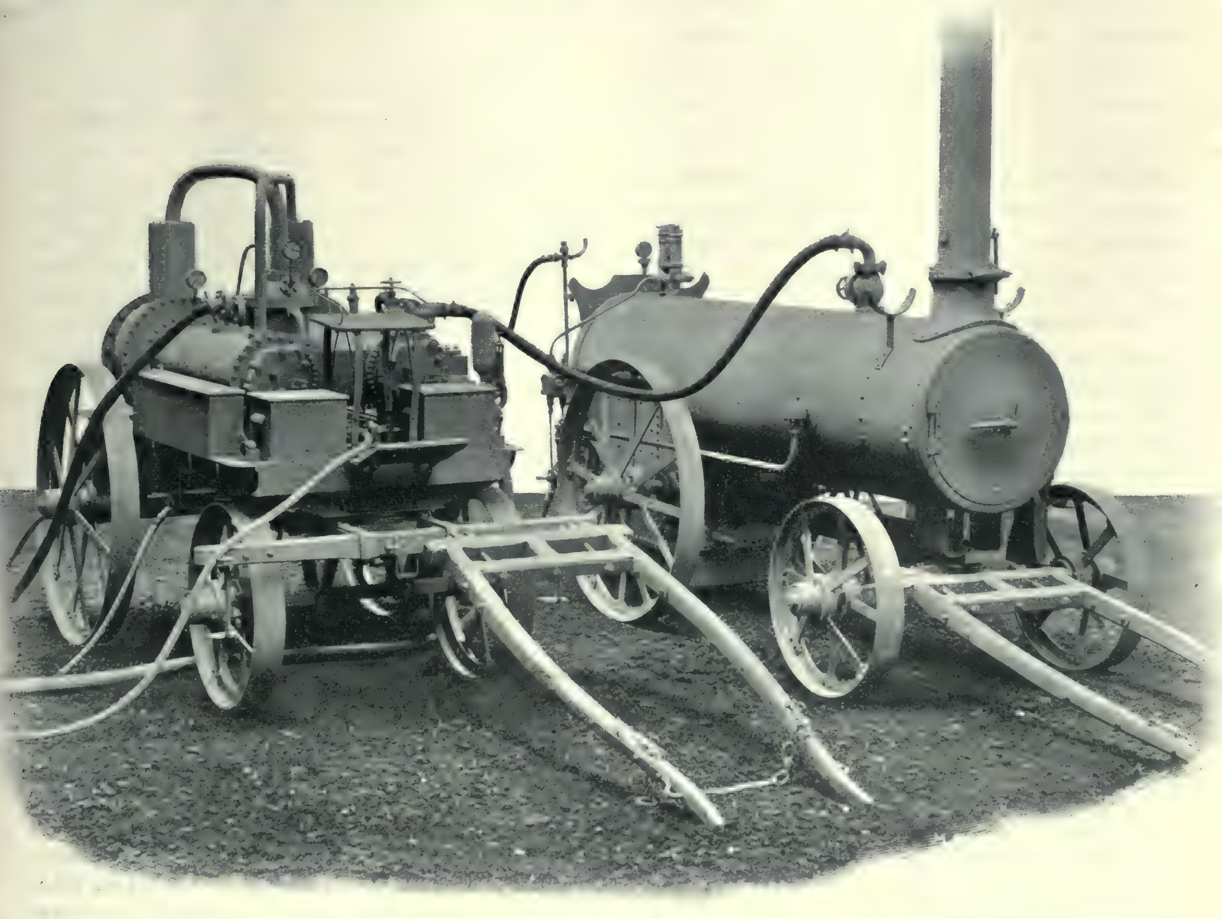
The following paragraph was submitted to Lord Rosebery for verification :—

Although nearly eighteen months have passed since Lord Rosebery propounded his excellent scheme for a post-graduate technical college for London, on the lines of the famous Charlottenburg Hochschule, little more has been heard of the proposal, and it has been rumoured more than once that the scheme had been abandoned. The "Daily News," having made inquiries with regard to the matter, is able to state that there is some difficulty in finding the necessary money at the present time, but that the matter is under the consideration of a Government Departmental Committee, including representatives of the London County Council and the London University. It is possible that the Government may furnish a site, free of charge, at South Kensington, and that the Royal College of Science and the School of Mines may form the nucleus of the new institute.

In a letter to the Editor, Lord Rosebery states that the foregoing is substantially correct.

Projected Tunnel under the Hudson River.

The Delaware, Lackawanna and Western Railroad Organisation has decided to bring its trains to a terminal in New York City through a tunnel underneath the Hudson river, which will run from Hoboken to a point south of West Twenty-third-street, New York.



PORTABLE WATER-DISTILLING APPARATUS BY THE MIRRLEES-WATSON COMPANY, LTD., OF GLASGOW.
OUTPUT, 65 GALLONS PER HOUR.

THE WEEK AMONG THE TECHNICAL SOCIETIES.

INSTITUTION OF ELECTRICAL ENGINEERS.

PRESIDENTIAL ADDRESS BY MR. ALEXANDER SIEMENS.

The first meeting of the present session was held last week, when the incoming President, Mr. Alexander Siemens, delivered his presidential address.

Sir William Preece moved, and Professor S. P. Thompson seconded, a vote of thanks to Mr. R. K. Gray, the outgoing president for the manner in which he had carried out the duties of his office, and the resolution was carried with acclamation.

Mr. Alexander Siemens then delivered his address. He said that after deliberation he had taken for his subject the causes which influenced the growth of industries, and thereby the rise of institutions connected with them, matters which would bear further discussion, as they were of the most varied character, and were an apt illustration of the interdependence of all factors of modern civilisation.

THE FOUNDATION OF MODERN CIVILISATION.

The true foundation of modern civilisation was the lowering of the cost of production—in other words the progress of civilisation was in proportion to the cheapening of articles of consumption. Though this might sound purely materialistic, he pointed out that the process of lowering the cost of production, implying the employment of all the knowledge we could acquire and of all the training the best schools could give us, resulted in greater ease of obtaining the necessaries of life, and thus gave us more time to cultivate other aspects of our existence. In the electrical industry, as elsewhere, further progress appeared to be dependent on further lowering of the cost of its products. How this was to be done depended on a variety of circumstances. For "internal working," so to say, every industry depended on three principal factors—the capital, the workmen, and the management. To take capital first, its share in the value of the finished article was proportionate to the cost of the depreciation and the maintenance of the works and of their outfit, to the cost of the raw materials, and to the profit representing interest on the total invested. To minimise the first item, the works ought to be planned and equipped so as to turn out the maximum of produce, and the machinery should be selected and laid out so that its wear and tear was due to legitimate working only, and the handling of all materials was reduced to a minimum.

RAW MATERIAL A MISNOMER.

As to the cost of raw materials, it should be incidentally noted that practically there was no such thing as raw material. It was true that each industry worked up what it designated as raw material, but this again was the finished products of other industries; even the products of nature, whether minerals, plants or animals, formed the basis of great industries, and were more correctly called finished articles than raw materials. In any case, for the natural progress of industries, the cost of the materials they worked up should be kept as low as possible. There was apparently not much difficuliy in diminishing the third item, profit on capital; but it stood to reason that the interest earned could not fall below a certain amount without the industry in question losing the support of capitalists and collapsing. In considering the influence of the workmen on the value of the product, it was clear that the amount of work turned out in a given time had a two-fold influence on the result, since the time occupied in producing an article not only regulated the amount of the wages, but also the proportion of the dead charges to be debited to the article. Hence, in order to contribute his share to the lowering of the cost of production, the workman had to turn out a greater quantity of the article in a given time. The most important of the legitimate ways in which the amount of wages to be charged against an article could be diminished, was the substitution of machine work for hand labour; and where this was done unskilled labour should be employed to run the machine under the supervision of a few skilled artisans. Whenever confronted with a new labour-saving machine the working-man, untaught by experience, still aired his old grievance that it would deprive him of his living. But it was undeniable that the introduction of machinery, instead of making skilled labour superfluous, had resulted in more skilled workmen being employed and at better wages than before, and similar developments were likely to follow when the workman was still further relieved from hard toil by his best friend, the labour-saving machine.

Restriction of output nowadays had exactly the opposite effect to that intended. When the price of an article was raised, owing to the supposed remedy for want of work, a number of consumers began to do without it, and fewer people could be employed in its production.

A TRADE UNION FETISH.

Another fetish of the working man was the desire that all workers should be treated alike, no preference being given to the capable and industrious over the lazy and careless. Mr. Siemens narrated a personal experience of the disastrous effect of this policy. Twenty-five years ago he erected at Leeds the first continuous working tank glass furnace for bottle making. This avoided many of the difficulties of the old method of melting the glass in pots, and the secretary of the trade union, who happened to work at the furnace, expressed his great satisfaction with the appliance. Though the prices were lowered, the men earned more money than with the old method. But when the owners wished to put up more furnaces of the same kind the union threatened to withdraw all its members; and the explanation given by the secretary was that it was precisely the advantages enjoyed by men working at these furnaces that induced his council to prohibit more from being built, as it was improbable that all the Yorkshire employers would follow suit, and they did not wish to see some of their men working under better conditions than others. To this decision the union adhered for nearly twenty years, and in consequence scarcely any glass bottles were now made in England.

ON PATENT LAW.

In regard to management, Mr. Siemens discussed only the influence of design in reducing cost of production, pointing out in this connection the necessity of using standard sizes and advantage of designing new work in such a way that the difficulties of manufacture should be a minimum. Turning to external factors that influenced the well-being of industries, he strongly urged the advantages of the metric system, and refuted some of the objections advanced against it. In regard to patents, he drew attention to the fallacy of considering a preliminary examination, as practised in the United States, for instance, to be of any advantage to an inventor. It involved as much trouble as a lawsuit, and it was no bar to a lawsuit being started later on, whereupon the case had to be argued again. The favourable result of such an examination was thus no guarantee of validity, though he admitted anticipations might be detected by the search. But it was the business of an inventor to make himself acquainted with what had been done before in his subject, and searching records would prove to be a liberal education and to be of more advantage to him than having this work done for him. Finally, Mr. Siemens said that, if complaints were raised that foreign competition was ever increasing, and proposals were made to protect British industries against it, two points required particular attention. One was that it was hopeless to endeavour to re-establish our former monopoly; and the other was that it might be useful to investigate whether our former industrial supremacy had not led to neglect in many respects, for which we now had to suffer. Whatever remedies might be proposed to enable British industries to hold their own against general competition, there was, in his opinion, only one safe test for selecting the right ones, and that was that their adoption should lower the cost of production for the benefit of the whole community.

THE INSTITUTION OF CIVIL ENGINEERS.

COAST EROSION.

At the ordinary meeting on Tuesday, November 8th, Sir Guilford L. Molesworth, K.C.I.E., President, in the chair, two papers were read, namely, "Coast Erosion," by A. E. Carey, M.Inst.C.E.; and "Erosion on the Holderness Coast of Yorkshire," by E. R. Matthews. The following are abstracts of these papers:—

Mr. Carey points out that, in the struggle between sea and land the frontiers of England are being continuously pushed back, but land wastage from this cause is a matter which is left almost entirely to those immediately concerned. The author suggests that a short Act clearly defining the law is the first requirement, and urges that a new body should be created with the special function of dealing with the foreshores of England and Wales as a whole, unfettered by the restrictions now existing. He then details the functions and powers with which he thinks this Coast Commission should be invested, and points out that under the title of "mundbriech" the Cinque Ports formerly enjoyed similar rights under Royal Charters. He also suggests the division of the necessary expenditure between the Treasury, the local authorities and the landowners, and the rights which should be conferred upon the Commission in the possible acquisition of foreshore lands, as well as their management.

Mr. Matthews in his paper deals with the effects of erosion on the most strongly attacked portion of the English seaboard, namely, the coast between Bridlington and Spurn Head, and gives an account of the remedial measures which have been adopted at Bridlington and at other towns, and of their effects upon the foreshore. Almost the whole of this coast line is being eroded at an average rate of about three yards per annum.

PROTECTIVE ENGINEERING MEASURES.

The author describes the various works that have been carried out from time to time, with the object of protecting the coast at Bridlington, Hornsea, Withernsea and Spurn Point. During the past thirty-five years the Corporation have spent about £73,000 in protecting the north foreshore of Bridlington, the south foreshore being maintained by private land-owners. The sea-defence works at Bridlington consist of seawalls built along the shore and groynes projected across the foreshore either at right angles to the coast line or approximately so. Some of the walls are constructed of timber, with a filling of block chalk; others are of concrete and masonry. Their design is described and illustrated in detail by the author.

The earlier heavy timber groynes, consisting of timber frames filled with chalk proved fairly effective in breaking the force of the waves, but were too high to have proper effect in causing accretion on the foreshore. The later construction of four long low timber groynes, however, had the result of causing, within three years, the accumulation of 500,000 tons of sand on the foreshore, raising the beach to an average height of about 4 ft. over an area of 26,000 square yards; and a further nine groynes of the same kind have had a similar effect. The protective works at Hornsea consist of groynes and timber breastwork, carried out by private enterprise. At Withernsea, six groynes and a sea-wall along the whole frontage have been of great service in maintaining the foreshore. The timber groynes erected by the Board of Trade between Kilnsea and Spurn Point and at the Point have been very successful, and have resulted in the accumulation of an immense quantity of shingle and sand.

WAYS AND MEANS.

The author proceeds to consider what measures are needed for the protection of the whole of the Holderness coast, and suggests that a continuous permanent sea-wall along the whole length, and also ten long groynes per mile would be required. He is of opinion that the latest type of sea-wall and groyne constructed by him at Bridlington would be suitable, and he finds that the cost of the suggested works on this basis would be about £1,247,000, of which £110,000 would be for groynes. On the other hand the value of the land swallowed up by the sea in the thirty-three years' life of the groynes would be about £34,000, or only about one-third of the cost of the groynes alone. Consequently it is impossible that the landowers should bear the cost of protection, and the question naturally arises, "Who should bear it?" The author strongly urges that this is a matter of national importance, and that just as the Board of Trade protects Spurn Point and four miles of coast line adjoining it, so the whole of the coast line between Kilnsea and Bridlington should be protected by them against the inroads of the sea.

The paper concludes with some particulars of what is being done by Government in Holland and Belgium to protect the foreshores of those countries, and of the amount of money devoted by the Belgian Government to such work; also with statistics of the loss of land throughout Great Britain in the years 1867.1900.

SOCIETY OF ENGINEERS.

The Jubilee Conversazione of the Society of Engineers was held at the Royal United Service Institution on Wednesday evening. A number of distinguished guests were invited, and among those who accepted invitations were Admiral Sir John Hay, Bart., G.C.B., Admiral Barry (Director of Naval Ordnance), General M. Protheroe, C.B., Sir Edward Reed, K.C.B., Sir Douglas Fox, Sir Leader Williams, Dr. Francis Elgar, F.R.S., and Dr. A. B. W. Kennedy, F.R.S.

The Museum of the Institution was thrown open, and a military band played at intervals during the evening. A short lecture, illustrated by lantern slides, was given in the lecture theatre by Mr. George A. Goodwin, past president, descriptive of his visit to Japan and the Far East.

A vocal entertainment was given at intervals in in the theatre, and there were the usual light refreshments,

The opening meeting of the new session of the Institution of Junior Engineers is to take place this evening, when Mr. W. H. Lindley, M.Inst.C.E., F.G.S., of Frankfort-on-Maine, is to deliver the presidential address, his subject being "Municipal Engineering on the Continent."

The Society of Motor Manufacturers hold their dinner at the Hotel Cecil, Strand, on Tuesday next.

A paper on the "Systematic Promotion of British Trade" will be read at the Society of Arts on Wednesday next.

THE INSTITUTION OF MINING AND METALLURGY.

The second ordinary meeting of the fourteenth session was held at the rooms of the Geological Society, Burlington House, Piccadilly, London, W., yesterday.

The new papers on the agenda were "The Blake-Morscher-Electro-Static Separator," by Mr. Ernest A. Wernberg; "The Baltic Mill and Lake Superior," by Mr. E. D. McDermott and "A Method of Testing Alluvial Deposits," by Mr. H. E. Nicholls.

THE BLAKE-MORSCHER SEPARATOR.

The principle involved in this separator relates to the behaviour of a mixture consisting of conductors and non-conductors when brought into an electrical field.

The separator, fig. 1, is constructed almost entirely of pine timber, and is 10 ft. 6 in. long, 8 ft. high, and 3 ft. 4 in. wide; as a rule two are mounted together so as to form one unit.

The ore is fed by means of a small cup elevator at one end of the separator into the box E, which is provided with the screw conveyor D, acting as distributor for the two feed-hoppers F1, F2, which are slotted (¼ in.) for their entire length. From here the ore drops on the feed boards, G1, G2, made of oak, which can be adjusted at the ends to various degrees of inclination by means of eye-bolts and turn-buckles H1, H2, H3 and H4, are adjustable gates, made in about 12 in. lengths and provided with thumbscrews to allow the gates to be lowered or raised according to the feed required. When the space is enclosed by the feed boards G1, G2, the backpieces and the adjustable gates full of ore, the discharging slots of F1, F2 are covered, thus preventing an overflow of material over the sides of the feed board.

The ore finally reaches the revolving repelling-poles J1, J2; it will be noted here, that the separator has four of these poles, J1, J2, J3, J4, arranged in pairs above each other, and connected with a source of electricity in such a way that the upper two are negative and the lower two positive.

Underneath the poles J1 and J2 is a system of pockets allowing the collecting of three separate products, namely: K1, good conductors, which are repelled furthest; L1, lesser conductors (here middle product), which are slightly repelled, M1, non-conductors or insulators, which are not repelled at all.

Product K1, consisting of good conductors, is discharged at the point O upon the feed board G3, and falls from here upon the finishing pole J3, which separates it into two products, K2 and L2. K2 is a finished product, consisting of good conductors, and is discharged from the separator by means of the screw conveyor B. L2 is a middle product, consisting of lesser conductors.

Product M1 is discharged through a number of pipes Q, upon the feed board G4, and goes from here to the finishing pole J4, where it is likewise separated into

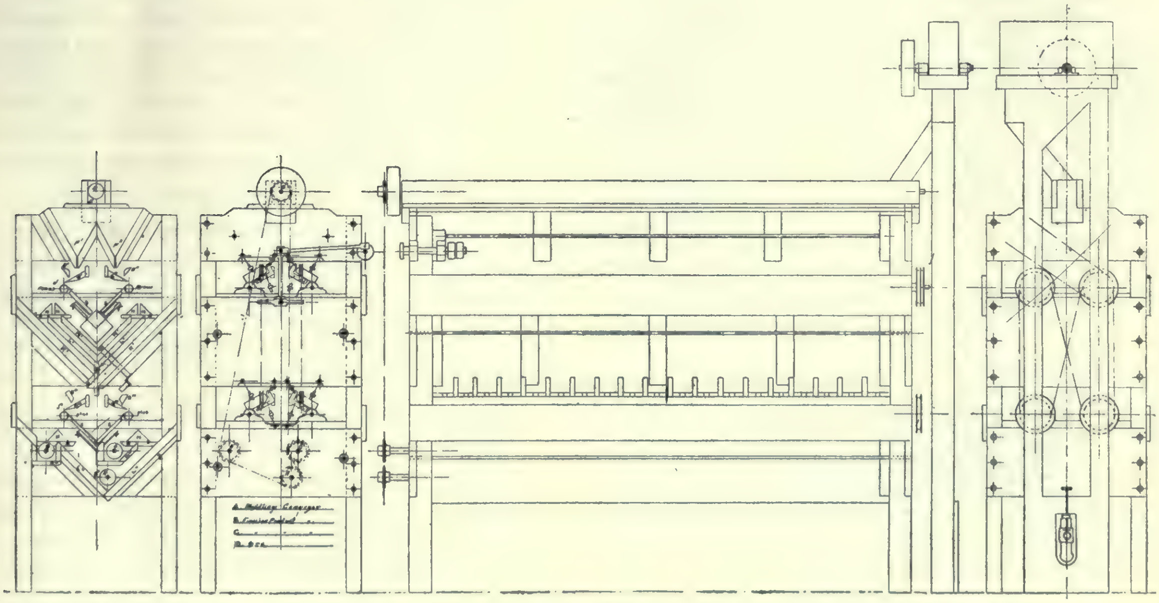


FIG I. THE BLAKE-MORSCHER ELECTRO-STATIC SEPARATOR.

the two products, M2 and L2. M2 is a finished product, consisting of non-conductors or insulators, and is discharged by the screw conveyor C. L2 is a middle product, consisting of lesser conductors.

All middle product, L1 and L2, coming either from the upper or lower poles collect at P2, and are conveyed back by screw conveyor A to the boot of the small cup-elevator, which delivers the material again into the box E.

Should this middle product require further crushing, it is obvious that a different arrangement must be adopted, whereby it can be conveyed direct to a set of fine rolls or any other grinding appliance which may be available.

WAGNER MICA PLATE STATIC MACHINE.

The author of this paper used a Wagner Mica Plate Static machine as the source of electricity in his experiments, and in Colorado and Wisconsin where larger installations are in operation this machine has also been adopted. The Wagner machine is very little known in England.

Like all static machines, electricity is developed by an influence upon the molecular structures of the air. In the Wagner machine the action takes place between strips of tin-foil and paper (the inductors) sealed between two stationary glass plates (32 in. in diameter), and the air in contact with the outer surfaces of two revolving mica plates (28 in. diameter and $\frac{3}{16}$ in. thick). The mica plates have been built up of many layers of thin mica plates and shellac, which finally have been submitted to hydraulic pressure. The surfaces are heavily shellaced and required to be recovered from time to time. The plates are very solid and may be handled like steel plates.

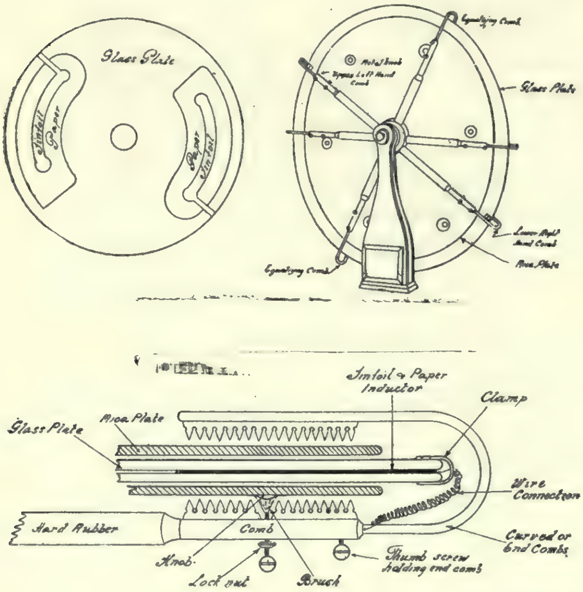


FIG. 2. WAGNER MICA PLATE STATIC MACHINE.

In order to set up an action on the air, the strips of tin-foil and paper are charged initially from the frictional charge developed by six small wire brushes, which are held in the collecting combs in such a manner as to strike six small metal knobs cemented by means of shellac upon the surface of the mica plate.

The frictional charge generated by the brushes is picked up by the lower right-hand comb and the upper left-hand comb, and is communicated to the inductors through a wire, which is held in contact with the strips of tin-foil (leading out from the inductors between the glass plates) by a clamp. The arms holding the collecting combs are made of hard rubber, with the exception of the upper right-hand arm and the lower left-hand arm, which are holding the equalising combs, and are made of black-enamelled brass.

The mica plate and the metal flange holding the hard rubber arms and collecting combs are mounted on a short piece of stout shafting; the bearings are ball bearings, and the mandrils are packed with sufficient hard oil to last several months. The glass plates do not touch the shaft, but are held between the mica plates by one upper and two lower hard rubber supports, which are slotted to take in the glass plates.

In order to make wire connections with the separator, two connecting rods are screwed into the central collecting combs, and extend about 12 in. outside, through a hard rubber bushing.

The speed of the static machine may vary between 500 and 1,000 revolutions per minute, according to requirements; the voltage is a very high one, varying according to speed from 200,000 to 300,000 volts, while the volume of the static current amounts to only a few milliamperes.

As to the power, 3 h.p. is required for one static machine and two separators.

The separator has, claims the author of the paper, opened up a new field and it is likely to become a valuable accessory to other ore-dressing appliances. It has done useful work in separating blende from pyrites, and is believed to be particularly well adapted to the separation of dia-magnetic blende.

New Buildings for Edinburgh University Engineering School.

SINCE the close of the summer session in July last an event of considerable importance has happened to the University Engineering School. The University Court having definitely decided that it was necessary that new buildings should be erected for the Engineering and Natural Philosophy departments, have for some time been searching for a suitable site; that site has now been acquired, the Town Council of Edinburgh have sold to the University for £15,000 the ground and the buildings left vacant by the opening of the new City Hospital at Colinton Mains. The block at the north end of the old hospital buildings, including that portion which was originally the Edinburgh High School, has been assigned to the Engineering Department, and during the past summer the Professor of Engineering, Professor Hudson Beare, has been engaged in the preparation of the preliminary plans in connection with the utilisation of these buildings. In view of the old memories which cluster round the old High School buildings, the plans have been drawn so as to avoid altering the external appearance of the buildings; the requirements will be met almost entirely by internal alterations. These new buildings will provide greatly increased accommodation, which is urgently needed.

On the ground floor of the front block will be large laboratories for testing of materials, and for hydraulics, and on the upper floor class-rooms, photographic rooms, laboratories for special work, etc. The block of buildings standing behind the main block will be converted into a large lecture theatre, and above this will be a large, well lit, drawing office. There is every hope that within the next twelve months the necessary alterations will be carried out, and that by this time next year the Department may be able to move into the new buildings.

OBITUARY.

Mr. G. L. Watson died at Glasgow on Saturday last at the early age of fifty-three. He was admittedly one of our leading yacht architects, and yet, in spite of his work in designing challengers for the America Cup, he will probably be best remembered as designer of the King's racing cutter *Britannia.*

By the sudden death of Mr. W. Maliphant, South Wales has lost one of its prominent industrial chiefs He had been associated with the tin plate trade for over thirty years.

The death is announced of Mr. L. Woodward, managing director of Moses, Mellor, and Sons, Ltd., machine makers, Nottingham. Mr. Woodward took an active part in local public life.

The death is announced of Mr. Joseph Smith, head of the firm of Walker and Smith, iron founders, of Batley.

A well-known civil engineer has passed away in Mr. F. McClean, M.Inst.C.E. The deceased, who was a pupil of the famous Sir John Hawkshaw, was a partner in the firm of McClean and Stileman, and during his professional career was identified with many important public works. He was a recognised authority on dock construction, and made original researches in the domain of astronomy.

The death of Mr. John Curry, engineer to the Hetton Coal Company, is announced. Mr. Curry had been chief engineer at Hetton for the past six years.

Mr. Thomas Merthyr Guest, eldest brother of Lord Wimborne, died last week at this country seat near Blandford

A familiar figure at Newcastle will be missed in Mr. W. Eltringham, whose death occurred last week. He had been in business on Quayside as long as most people can remember.

The death is reported of Mr. G. Fleischer, the chief of the Ameer's gun factory, who is said to have been murdered on his journey to India. Mr. Fleischer held a position in Krupp's factory at Essen before taking service under the Ameer's government, six years ago.

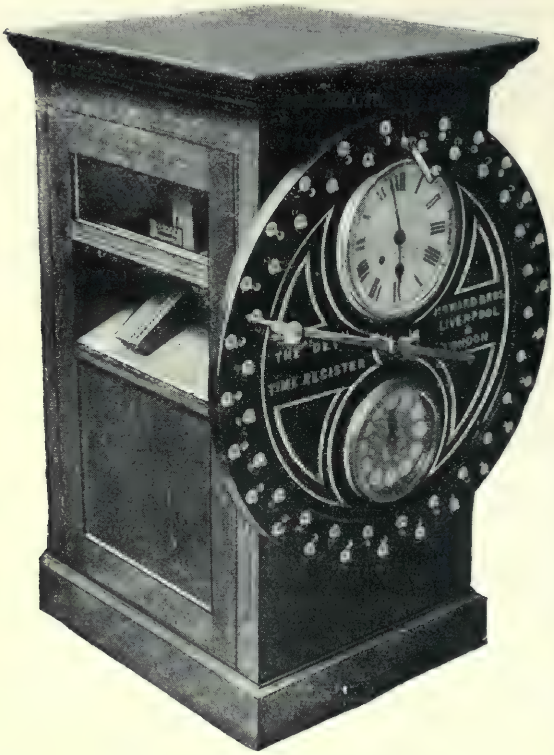
Mr. Christopher James, whose death took place last week will be remembered for his claims in connection with the block system of signalling, around which a controversy was waged in the technical press. He served his time as an engineer in the Swindon works of the Great Western Railway.

THE "DEY" TIME REGISTER.

AN IMPORTANT DEVELOPMENT.

In view of the growing use of automatic time registers in this country, and the articles on "Business System" which have from time to time appeared in our columns, the readers of Page's Weekly will, doubtless, be interested in a new improvement which Messrs. Howard Bros. have successfully incorporated in their "Dey" Time Register.

By this they are enabled to supply the card system for cost keeping in addition to the combined weekly time and wages sheet. Manufacturers are frequently inclined to look askance at any cut-and-dried business system, owing to the fact that their existing methods, although, perhaps, by no means perfect, do not admit of any sweeping change or the entire substitution of a new system. This feeling has, no doubt, been taken into account by the designers of the "Dey" Time Register, which is arranged upon such a basis that it can be adapted to varying requirements; in fact, we understand that with this machine, it is now possible to produce a facsimile of any works' time and wages sheet by combining the two.



THE "DEY" TIME REGISTER,
Showing New Attachments.

The machine takes a sheet and registers in bold type the exact time of the men's "in-goings" and "out-goings," which, at the end of the week are all ready for totalling and extending in £ s. d. columns, showing the net amount of pay. Of course, the great advantage of having a time and wages sheet combined, is the fact that it entirely dispenses with the various time books and wages books as now used where the "Dey" time system is not in vogue. Another advantage is that the pay clerk pays from the original sheet, and therefore can settle any questions raised by the men in a moment, simply by referring to the sheet, the record on which is indisputable, for each man registers his own time, and, therefore, cannot get away from what is printed thereon. The sheets are pasted each week into a compact book, where they are available as a permanent record.

In some of the works where the "Dey" Time Registers are used for marking the time of employees, the machines are distributed departmentally, and for cost purposes boards are used, and in some cases cards, upon which the men write the time expended on the different jobs, and the cost department checks the total time shown at the boards by the total time for each man recorded on the "Dey" Time Registers. The two records must, of course, tally one with the other.

Many works' managers are of opinion that the two systems—*i.e.*, time and wages sheets and cost cards—can be advantageously combined, and it is owing to this circumstance that Messrs. Howard Bros. have perfected their new card attachment, which, by the way, is contained in the machine without increasing its bulk. The "Dey" registers both the cards and the sheets without in any way interfering with the setting of the machine from "in" to "out" and *vice versâ*.

The question of using cards or sheets for time and wages is one upon which there is a decided difference of opinion; some firms apparently find that loose cards are too cumbersome, and entail too much clerical work. It is anticipated that in the time and wages sheets and cost cards operated by the "Dey" Register a method has been achieved which will revolutionise time recording.

CONTRACTORS' NEWS.

We shall be pleased to insert under this column, free of charge, particulars of open contracts.

CONTRACTS OPEN.

	Last Day.
Brentwood.—Supplying and fixing direct-acting steam duplex pump (Worthington type) for the Essex County Asylum. Medical Superintendent	Dec. 3
Dewsbury.—Supplying steam boiler at the Infectious Diseases Hospital for the joint hospital board. Holtom and Fox, Corporation Street, Dewsbury	Nov. 19
Cheshire Lines.—Iron and steel stores for the committee. Stores superintendent, Cheshire Lines, Warrington	Nov. 25
West Hartlepool.—Iron and steel stores for the Corporation, Mt. Nelson. F. Dennis, Municipal Buildings, West Hartlepool	Nov. 24
Dublin.—Iron and steel stores for Midland Great Western Railway. General stores department, Broadstone Street, Dublin ...	Nov. 28
Dublin.—Iron and steel stores for the Commissioners of Irish lights	Nov. 24
Fleetwood.—Supplying 2,364 lineal yards of cast-iron sea out-fall sewers (36 in. and 18 in. diameter) for the Council. Mr. G. R. Strachan, 9, Victoria Street, London	Nov. 26
Manchester.—Supplying two 5-ton overhead travelling cranes, and one 15-ton crane for the Corporation. Mr. J. M. McElroy, General Manager, Tramways Department, Town Hall, Manchester ..	Nov. 22
Newport (Mon.) — Supplying various machine tools. Borough Electrical Engineer, Town Hall, Newport	Nov. 21
Oldham.—Supply, delivery and erection of two negative return feeder boosters (with switch gear and boards for tramway system). Mr. S. W. Newington, Electricity Offices, Greenhill, Oldham... ...	Nov. 25
Hambledon.—Supplying cast iron water main for the District Council	Nov. 23
Harrogate.—Supplying cast iron pipes for the Corporation. Mr. W. E. Dixon, Engineer	Nov. 26
Branksome.—Construction of cast iron sewer for the Council. Mr. W. H. Curtis, Clerk	Nov. 30
Caledonian Railway Company.—Supplying stores for twelve months, from January 1st, 1905. Mr. Jos. Lorimer, Store Superintendent, Caledonian Railway, Glasgow	Nov. 21
Glasgow.—Wiring and switchboards for the new building, Glasgow and West of Scotland Technical College. Mr. H. F. Stockdale, 38, Bath Street, Glasgow ...	Nov. 26
Southampton.—Installation of electric light in the new school at Portswood. About 260 lights. Borough Electrical Engineer, Southampton	Nov. 21
West Calder.—For the construction of about one mile of railway and sidings at Gavieside, near West Calder. Messrs. D. and C. R. Rankine, 238, West George Street, Glasgow	Nov. 21
Cambrian Railway.—Supplying of six motor vehicles for omnibus service. Mr. H. E. Jones, Locomotive Superintendent, Oswestry	Dec. 3
London.—Supplying one steam motor and bogie for steam motor carriage. Agent-General, South Australia, Threadneedle House, Bishopsgate Street, E.C.	Nov. 28
Whitby.—Supply and erection of one 200 kw. direct current dynamo, coupled to a high-speed engine (reciprocating or turbine type), and one watertube boiler, fitted with chain grate and mechanical stoker. Mr. L. H. King, Electrical Engineer	Nov. 21
Great Yarmouth.—Supply of about 800 tons of steel girder tramway rails, etc., for Town Council. Mr. W. Edgar Stephens, Town Clerk	Nov. 22
Somerset.—Sinking of well in connection with the Somerset and Bath Asylum. Mr. W. Phelps	Nov. 30
Edinburgh.—Erection of City wall for the Corporation. Public Works Office ...	Dec. 5
Cardiff.—Competitive designs and tenders for supply of pumping machinery, and plant required in connection with the proposed western district main outfall sewer. Contract No. 1—for combined sewage pumping engines and pumps of a maximum capacity of 700,000 gallons per hour; 2—for the steam generating plant required for Contract No. 1; 3—for two sets of gas engines and centrifugal storm-water pumps, each capable of discharging 680,000 gallons per hour. Particulars at the office of Mr. W. Harper, borough engineer, Town Hall, Cardiff	Dec. 21
Leith.—Supply of rails, etc., for the Corporation. Town Clerk, Leith	Nov. 26

COMING CONTRACTS.

Bedwellty.—The Board of Guardians have decided to light the Workhouse by electricity at a cost of £2,000.

Cardiff.—The Lighting Committee has put forward a proposal to apply for a loan of £87,000 for electric supply extensions.

Retford.—The Corporation is considering a proposition to put down a gas-driven electric supply plant at an estimated cost of £10,000.

South Shields.—The Council has under consideration a proposition to seek powers to construct electric tramways.

Whitstable.—An electric supply scheme is receiving the consideration of the Town Council.

Gillingham.—Sanction has been obtained to the proposal of the Council to borrow an additional £19,754 for electric lighting extensions.

Camberley.—Sewage works to cost £40,000 are under consideration by the District Council.

Lancaster.—A sum of £80,000 is to be spent on new municipal buildings and public works.

CONTRACTS CLOSED.

Abergavenny.—An order for a battery of 130 cells from the Asylum has been placed with Pritchetts and Gold, Ltd., Feltham; engine and battery rooms, T. G. Thomas and Sons, £1,140; Woods, Slacke and Co., lighting plant, £2,364; Scott and Mountain, wiring, £2,640.

Barrow-in-Furness. — The Corporation have acceped the tender of the Improved Electric Glow Lamp Company, at £996 10s., for arc lamps, columns, etc.

Fulham.—The Borough Council have accepted the tender of the Bristish Thomson-Houston Company, Ltd., at £492 for a switchboard.

Uxbridge.—An order has been placed with the Hart Accumulator Company, Ltd., for storage battery (278 cells) for the lighting of Northwood.

Richmond.—The Main Sewerage Board has placed the order for pumping installation with the Brush Electrical Engineering Company, Ltd.

London.—The County Council have accepted the the tender of D. R. Patterson, for the construction of a relief sewer, at £30,713.

Admiralty.—Important contracts have been awarded to the United Asbestos Co., Ltd., for the supply of their specialities. Isaac Storey and Sons, Ltd., Manchester, are supplying three sets of condensing plant.

Midhurst.—The heating, lighting, and power plant of the King Edward VII. Sanatorium is being supplied by Dargue, Griffiths and Co., Ltd., Liverpool.

Barry.—The Barry Railway Company have placed an order for six locomotives with Hudswell, Clark, and Co., Ltd.

London.—The contract for four high-speed engines for electric lighting of Sheerness dockyard has been placed with Davey, Paxman, and Co.

Paisley.—An order for four tramcar trucks has been placed with the Brush Electrical Engineering Co., Ltd.

Rochdale.—The Corporation have accepted the tender of G. H. Woods, Slacke, and Co., Blackburn, for car shed wiring.

Battle.—The District Council have placed the contract for laying steel pipes for sewers with Waller and Co., Eastbourne.

Brussels.—The authorities have accorded the contract for the central station of Brussels to the Allgemeine Electricitats-Gesellschaft, who have agreed to carry out the work for 4,137,000 fr. The figures given in the Press—viz., 1,285,000 fr.—are incorrect.

Glasgow.—The North British Station Hotel is to be ventilated with electric fans, which are being supplied by Messrs. Matthews and Yates, of Cyclone Works, Swinton, Manchester, who have also supplied the fans for the company's hotel at Edinburgh.

APPOINTMENTS VACANT.

	Last date for application.
Birmingham. — Lecturer in electricity and physics, at the Municipal Technical School. Salary £140	Nov. 19
Central South African Railways.—Chief locomotive superintendent. Salary £1,700 per annum, with a personal allowance of £300. Crown agents for the Colonies, Whitehall Gardens, London, S.W.	Nov. 24
Poplar.—Mains superintendent, electricity works. Salary £120 per annum	Nov. 18
Blackburn.—Mains superintendent, electricity works. Salary £130 per annum ...	Nov. 18

APPOINTMENTS FILLED.

Marylebone.—Mr. C. H. Smyth, late chief-assistant at Willesden, has been appointed Main superintendent by the Council, at a salary of £230 per annum.

Faversham.—The Town Council have appointed Mr. Wolf assistant engineer at the electricity works.

Southwark.—Mr. D. M. Kinghorn, electrical engineer and manager to the Leigh Corporation, has been appointed chief engineer and manager to the Southwark Borough Council's electrical undertaking.

Pontypridd.—Mr. J. C. Teasdel, of Cardiff, has been appointed to the position of resident engineer in connection with the electric tramways and generating station of the Pontypridd Urban District Council. Eighty-six applications were received for the appointment, to which is attached a salary of £300 a year.

Share List of Engineering, Electrical, Iron and Steel, and other Companies.

The following is a comprehensive list of Companies in the industries covered by "Page's Weekly," in which shares business is being currently transacted. Additions will be made from time to time as occasion requires. We desire it to be understood that while our Share List will generally be found correct, we do not hold ourselves responsible for any loss or inconvenience that may arise from possible inaccuracies.

STOCK EXCHANGE SETTLING DAYS.—Settling days on the Stock Exchange are as follows:—

Consols: December 1st. General Settlements: November 30th, December 15th, 30th. Bank Rate, April 21st, 3 per cent.

I.—ENGINEERING, IRON, AND STEEL COMPANIES.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
3,210,000	1	2/6	Armstrong (Sir W. G.), Whitworth and Co., Ltd.	1	3 — 3⅛
76,970	5	2/-	Do. 4% Cum. Pref.	5	5¼ — 5½
£1,500,000	100	4%	Do. 4% 1st Mort. Dbs. Rd.	100	102 —104
£100,000	100	4½%	Aveling and Porter, Ltd., 4½% Reg. Mt. Debs. Red.	100	97 —100
530,000	1	1/7⅕	Babcock and Wilcox, Ltd., Ord. ..	1	3⅛ — 3⅜
100,000	1	7⅕d.	Do. „ 6% Cum. Pref.	1	1½ — 1⅝
20,000	5	3/-	Baker (Joseph) and Sons, Ltd., 6% Cum. Pref.	5	5 — 5½
250,000	1	6⅗d.	Baldwins, Ltd., 5½% Cum. Pref. ..	1	1 — 1⅛
£250,000	Stk	4½%	Do. 1st Mt. 4½% Deb. Stk. Red.	100	101 —103
150,000	4½	2/8⅖	Barrow Hæmatite Steel Co., Ld., O.	4½	1 — 1¼
50,000	4½	6/-	Do. do. Cum 2nd. Pref.	4½	3½ — 4
33,334	5	2/6	Bayliss, Jones and Bayliss, Ltd., 5% Cum. Pref. Shares	5	4¾ — 5¼
£500,000	100	—	Beardmore (Wm.) & Co., Ltd., 4½% 1st Mt. Debs., Red., Scrip 50% pd	—	50 — 52
50,000	10	6/-	Bell Brothers, Ltd., 6% Cum. Pref.	10	11½ — 12
£366,600	Stk	4%	Do 4% Deb. Stock, Red.	100	99 —102
149,850	1	6d.	Bengal Iron and Steel Ord.	1	⅞ — 1⅛
200,000	1	1/-	Beyer, Peacock and Co., Ltd., Ord.	1	½ — ⅝
300,000	1	6⅗d.	Do. 5½% Cum Pref.	1	$\frac{27}{32}$ — $\frac{29}{32}$
£300,000	Stk	4¼%	Do. 4¼% Red. Deb. Stock	100	96 — 99
1,629,760	1	6d.	Bolckow, Vaughan and Co., Ltd., O. Nos. 1-1,629,760	1	⅞ — 1
1,860,900	1	3⅗d.	Do. Nos. 1,639,101-3,500,000	12/-	½ — $\frac{9}{16}$
1,160,000	1	9d.	Brown (John) and Co., Lim., Ord., Nos. 1-1,160,000	15/-	1¼ — 1⅜
590,000	1	1/-	Do. Ord., Nos. 1,160,001-1,750,000	1	$1\frac{1}{16}$ — $1\frac{3}{16}$
74,000	10	5/-	Do. 5 % Cum. Pref.	10	11 — 11½
154,500	5	2/6	Cammell, Laird & Co., Ltd., Ord. .	5	7½ — 8
232,500	5	2/6	Do. 5% Cum. Pref. ..	5	$5\frac{1}{16}$ — $5\frac{3}{16}$
450,000	1	1/6	Clayton & Shuttleworth, Ltd., Ord.	1	⅞ — 1
70,000	5	2/6	Do. 5% Cum. Pref.	5	5⅜ — 5⅝
£250,000	Stk	4%	Do 4% 1st Mort. Db. Stk. Red	100	100 —102
100,000	10	30/-	Consett Iron Co., Ltd., Ord	7½	29 — 31
230,000	5	6/-	Cory (Wm.) & Son, Ltd., Ord. ..	5	7⅜ — 7⅝
170,000	5	2/6	Do. 5% Cum. Pref.	5	6 — 6¼*
£726,400	Stk	4%	Do. 4% 1st Mort. Db. Stk. Red	100	104 — 106
1,259,594	1	3⅗d.	Dorman, Long & Co., Ltd.	1	$\frac{17}{32}$ — $\frac{19}{32}$
£400,000	Stk	4%	Do. 4% 1st Mort. Perp. Deb. Stk.	100	93 — 96
£250,000	Stk	—	Do. 6% 2nd Mort. Deb Stk, Red. Prov. Crts. 60% pd. ..	—	56 — 58
273,000	1	1/-	Dundee Coal Co., Ltd. (Natal) ..	1	$\frac{15}{16}$ — $1\frac{1}{16}$
200,000	5	3/-	Dunderland Iron Ore Co., Ltd., 6% Cum. Pref. and Participating ..	5	3 — 3½
250,000	1	9⅗d.	Dunlop (James) & Co., Ltd., Ord. ..	1	⅜ — ⅝
300,000	1	7⅕d	Do. 6% Cum. Pref. ..	1	$\frac{13}{16}$ — $\frac{15}{16}$
4,721	13	12/-	Ebbw Vale Steel, Iron & Coal Co., Ltd.	13	8½ — 9½
69,754	13	12/-	Do. do. do.	10	7⅛ — 7⅜
25,000	10	6/-	Fairfield Shipbuilding & Engng. Co., Ltd., 6% Cum. Pref. ..	10	10½ — 11
£250,000	Stk	4½%	Do. 4½% Mort. Deb. Stk. Red.	100	99 —102
126,000	3	3/-	Fraser & Chalmers, Ltd., Ord. ..	3	4½ — 5
21,000	3	4/6	Do. 7½% Cum. Pref.	3	5½ — 6
965,000	1	1/-	Guest, Keen & Nettlefolds, Ltd. Ord.	1	$2\frac{3}{16}$ — $2\frac{5}{16}$
344,000	5	2/6	Do. 5% Cum. Pref.	5	5¾ — 6
£1,850,500	Stk	4%	Do. 4% Irred. Mort. Deb. Stk	100	105 —107
13,000	5	2/6	Gwynnes, Ltd., 5% Cum. Pref. ..	5	2½ — 3½
250,000	1		Hadfield's Steel F'dry Co., Ld., Ord.	1	2⅞ — 3
20,000	10	4/6	Do. 4½% Cum. Pref.	10	10½ — 11
30,000	5	3/-	Hall (J. & E.), Ltd. 6% Cum. Pref. ..	5	5 — 5½
408,505	1	1/6	Harvey United Steel Co., Ltd. ..	1	$\frac{15}{16}$ — $1\frac{1}{16}$
28,001	5	7/-	Head, Wrightson & Co., Ltd. ..	5	4½ — 5
85,000	1	7⅕d.	Hill (Richard) & Co. (1899) Ld., Ord	1	⅝ — ¾
18,000	5	3/-	Do. 6% Cum. Pref.	5	4¼ — 4¾
30,000	10	8/-	Hornsby (Richard) & Sons, Ld., Ord.	8	6½ — 6¾
750,000	1	10⅘d.	Howard & Bullough, Ltd., Ord. ..	1	1¼ — 1½
25,000	10	6/-	Do. 6% Pref. (Non-Cum.) ..	10	12¾ — 13¼
£250,000	Stk	4%	Do. 4% Deb. Stk., Red. after 1905	100	96 — 99
300,000	1	4⅘d.	Lambert Bros., Ltd., Ord.	1	⅝ — ⅞
50,000	5	2/9	Do. 5½% Cum. Pref.	5	4 — 4½
40,000	3	2/1⅕	Leeds Forge Co, 7% Cum. Pref. ..	3	3¾ — 4¼
$6,810,000	$1,000	5%	Lehigh Valley Coal Co., 1st Mort. 5% Guar. Gold Coup. Bds. ..	—	113 —117

ENGINEERING, IRON, AND STEEL COMPANIES.—*Contd.*

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
200,000	1	7⅕d.	Lysaght (John), Ltd., 6% Cum. Pf..	1	$1\frac{5}{16}$ — $1\frac{7}{16}$
£300,000	Stk	4½%	Do 4½% 1st Mt. Deb. Stk., Red.	100	108 —110
40,000	10	5/-	Mather & Platt, Ld., 5% Cum. Pref.	10	10¾ — 11¼
210,000	1	6d.	Measures Bros., Ltd., Ord.	1	$\frac{9}{16}$ — $\frac{11}{16}$
75,000	1	6⅗d.	Do. 5½% Cum. Pref.	1	$\frac{13}{16}$ — $\frac{15}{16}$
£75,000	Stk	4½%	Do. 4½% 1st Mrt. Db. Stk., Red.	100	96 —100
5,000	62½	47/6	Nantyglo and Blaina Iron Works, Ltd., 8% Cum. Pref.	62½	69 — 71
49,514	3	1/-	Nerbudda Coal & Iron Co., Ltd., O.	3	¼ —
11,548	20	8/-	New Sharlston Collieries Co., Ld. P.	20	14 — 15
73,000	10	5/-	N. Brit. Loco. Co., Ltd., 5% Cm Pf.	10	11¾ — 12
80,000	5	—	North-Eastern Steel Co., Ltd., Ord.	5	—
£250,000	Stk	4½%	Do. 4½% 1st Mrt. Db. Stk., Red.	100	92 — 95
120,000	5	5/-	North's Navig. Collieries ('89), Ld., O	5	5¾ — 6¼
10,000	5	5/-	Do. 10% Cum. Pref.	5	9½ — 10
122,000	5	2/-	Pearson & Knowles Coal and Iron Co., Ltd., Ord., "B"	5	3⅜ — 3⅝
50,000	5	3/-	Do. 6% Cum. Pref. "A" ..	5	5½ — 6
70,000	10	6/-	Pease & Partners, Ltd., Ord. ..	10	8 — 9
£400,000	Stk	4%	Do. 4% Perp. Deb. Stock	100	97 —100
20,000	5	3/-	Peebles (Bruce) & Co., Ld., 6% Cm. P.	5	4¾ — 5
230,000	1	—	Projectile Co. (1902), Ltd., Ord. ..	1	⅜ — ⅝
126,938	5	2/-	Rhymney Iron Co., Ltd.	5	1½ — 1¾
73,062	5	2/-	Do. New	5	1⅜ — 1⅝
£330,000	—	5%	Do. 5% Mort. Deb., Red. ..	100	101 —104
350,000	1	7⅕d.	Richardsons, Westgarth & Co., Ltd., 6% Cum. Pf. ..	1	⅞ — 1*
£350,000	Stk	4½%	Do. 4½% Perp. Deb. Stock ..	100	93 — 96
90,000	5	2/3	Rickett, Cockerell & Co., Ld. 4½% C.P	5	4½ — 4¾
150,000	1	3⅗d.	Russian Collieries, Ld., 7% Cm. Pf.	1	⅛ — ⅜
35,000	10	12/-	Ruston, Proctor & Co., Ltd... ..	10	9¼ — 9¾
275.000	1	6d.	Scott (Walter), Ltd., Ord.	1	⅞ — 1
300,000	1	7⅕d.	Do. 6% Cum. Pref. ..	1	$\frac{15}{16}$ — $1\frac{1}{16}$
£300,000	Stk	4%	Do. 4% Perp. Deb. Stk.	100	95 — 97
£115,300	100	5%	Shelton Iron, Steel and Coal Co., Ld. 1st Charge 5% Debs.. Red ..	100	91 — 94
£97,900	100	6%	Do. 6% 2nd Mort. Debs., Red.	100	90 — 95
7,500	10	6/-	Sneyd Collieries, Ltd., 6% Cm. Pref.	10	9¾ — 10¼
93,800	100	5%	Do. 5% Dbs. (Reg.) Red.	100	100 —102
250,000	1	1/-	South Durham Steel & Iron, Ltd. Or.	1	$\frac{9}{32}$ — $\frac{11}{32}$
300,000	1	7⅕d.	Do. 6% Cum. Pref...	1	½ — ⅝
£300,000	Stk	4½%	Do. 4½% Per. Deb. Stock	100	70 — 73
50,000	10	10/-	South Hetton Coal Co., Ltd., Ord. ..	10	17 — 19
30,000	10	5/-	Do. 5% Non-Cum Pref. .	10	9½ — 10½
25,000	10	—	Stephenson (Robert) & Co., Ltd., Or.	10	1½ — 1¾
25,000	10	5/6	Do. 5½% Cum. Pref. ..	10	3½ — 4
£250,000	Stk	4%	Do. 4% Perp. Deb. Stock	100	73 — 75
85,000	10	9/-	Stewarts & Lloyds, Ltd., Ord. ..	10	16¾ — 17¼
55,000	10	6/-	Do. 6% Cum. Pref.	10	14 — 14½
634,732	1	4.69d.	Swan, Hunter & Wigham-Richardson, Lim. Ord.	1	⅞ — 1
538,845	1	6d.	Do. 5% Cum. Pref.	1	⅞ — 1
£240,000	Stk	4¼%	Do. 4¼% 1st Mort. Deb. Stk. Red	100	98 —101
300,000	1	6d.	Thames Iron Works, Shipbuilding & Engineering Co., Ltd., 5% Cum. Pf.	1	½ — ⅝
£200,000	100	4%	Do. 4% Irredeem. 1st Mort. Deb.	100	66 — 70
£160,000	1	7⅕d.	Thornycroft (John I.) & Co., Ltd. 6% Cum. Pref.	1	$\frac{15}{16}$ — 1*
10,000	10	5/-	Tylor (J.) & Sons, Ltd. 5% Cum. Pf.	10	9¾ — 10¼
£942,900	100	5%	United Collieries, Ltd., 5% Debs. ..	100	65 — 70
$508495200	$100	$½	United States Steel Corp. Com. Stk.	$100	29 — 29¼
$360314100	$100	$1¾	Do. 7% Cum. Pref. Stock	$100	89½ — 90*
$162268000	$1000	5%	Do. 10-60yr. 5% Skg. Fd. G. Bds.	$1000	90 — 92
3,350,000	1	1/-	Vickers, Sons & Maxim, Ltd. Ord. .	1	$2\frac{5}{16}$ — $2\frac{7}{16}$
750,000	1	6d.	Do. 5% Non-Cum. Pref. ..	1	1⅛ — 1¼
£750,000	Stk	5%	Do. 5% Non-Cum. Pref. Stock.	100	110 —114
£1,250,000	Stk	4%	Do. 4% 1st. Mort. Deb. Stk. Red.	100	104 —106*
£1,000,000	100	4½%	Do. 4½% 2nd Mort. Debs., Red.	100	103 —105
225,000	1	1/2⅖	Weardale Steel, Coal & Coke, Ltd., Def. Ord.	1	⅝ — ¾
500,000	1	7⅕d.	Do. 6% Cum. Pref. Ord. ..	1	¾ — ⅞
£300,000	Stk	4%	Do. 4% Perpetual Deb. Stock	100	79 — 82
66,666	5	3/.	Willans & Robinson, Ord.	5	1 — 2
66,666	5	3/-	Do. 6% Cum. Pref.	5	2 — 3
£246,641	Stk	4%	Do. 4% 1st Mort. Deb. Stk. Red	100	74 — 79
£150,000	Stk	4½%	Yorkshire Iron & Coal Co., Ltd., 4½% 1st Mort. Deb. Stk. Red.	100	80 — 85

Stocks and Shares marked * are quoted ex-dividend.

II.—ELECTRICAL MANUFACTURING COMPANIES.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
70,000	1	6d.	Alliance Elec. Co., Ltd. 5% Cum. Pf.	1	⅝— ⅞
125,000	1	7⅓d.	Aron Elec. Meter Ltd., 6% Cum. Pf.	1	$\frac{7}{16}$— $\frac{9}{16}$
120,000	1	9⅗d.	Bell's Asbestos Co., Ltd.	1	½— ⅝
100,000	5	4/-	British Insulated & Helsby Cables, Ltd., Ord. ..	5	5½— 6
100,000	5	3/-	Do. 6% Cum. Pref.	5	5½— 6
£500,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk. Rd.	100	101 —104
£200,000	Stk	4½%	British Thomson-Houston Co., Ltd., 4½% 1st Mort. Deb. Stk. Red. ..	100	100 —102
400,000	5	3/-	British Westinghouse Electric and Manufac. Co., Ltd., 6% Pref. ..	5	3½— 3¾
£616,353	Stk	4%	Do. 4% Mort. Deb. Stk. Red. ..	100	89 — 91
35,000	5	5/-	Callender's Cable & Constn. Ltd. Ord.	5	9 — 10
40,000	5	2/6	Do. 5 % Cum. Pref.	5	5 — 5¼
£200,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk. Red.	100	103 —106
52,000	5	10/-	Dick, Kerr & Co., Ltd., Ord. ..	5	6¾— 7¼
61,000	5	3/-	Do. 6% Cum Pref.	5	5¼— 5½
£300 000	Stk	4½%	Do. 4½% Deb. Stock, Red. ..	100	103 —106
233,334	1	6d.	Doulton & Co., Ltd., 5% Cum. Pref.	1	1¼— 1½
£233,334	Stk	4%	Do. 1st Mort. 4% free. Deb. Stk.	100	106 —109
99,261	5	1/6	Edison and Swan United Electric Light, Ltd., "A" Shares Nos. 1-99,261	3	½— ¾
17,139	5	2/6	Do. "A" Shares Nos. 01-017,139	5	1 — 1½
£344,023	Stk	4%	Do. 4% Deb. Stock Red. ..	100	78 — 83
£100,000	Stk	5%	Do. 5% Second Deb. Stk. Red.	100	79 — 84
112,100	2	1/7⅕	Electric Construction Co., Ltd. .	2	1 — 1¼
31,390	2	2/9⅗	Do. 7% Cumulative Pref. ..	2	2 — 2½
£200,000	Stk	4%	Do. 4% Perp. 1st Mt. Deb. Stk.	100	97 —100
10,248	10	7/6	Evered and Co., Ltd.	10	13 — 15
£100,000	Stk	5%	Ferranti, Ltd., 5% 1st Mort. Deb. Stock, Red.	100	90 — 95
25,000	10	5/-	Gen. Elect. Co. (1900), Ltd., 5% Cum. Pref.	10	9½— 10
£200,000	Stk	4%	Do. 4% 1st. Mt. Deb. Stk., Red.	100	91 — 96
35,000	5	5/-	Henley's (W. T.) Telegraph Works Co., Ltd., Ord.	5	10¾— 11¼
35,000	5	2/3	Do. 4½% Cum. Pref.	5	5 — 5½
£50 000	Stk	4½%	Do. 4½% Mt. Deb. Stk. Red.	100	108 —111
50,000	10	5/-	India Rubber, Gutta Percha & Telegraph Works Co., Ltd.,	10	19½— 20½
£300,000	100	4%	Do. 1st Mort. Deb. Red. ..	100	99 —102
37,350	12	12/-	Telegraph Construction and Maintenance Co., Ltd.	12	36 — 39
£150,000	100	4%	Do. 4% Deb. Bonds	100	101 —104

III.—ELECTRIC TRACTION.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
120,000	5	3/-	Anglo-Argentine Trams Co., Ld., Or.	5	6⅞— 7⅛
260,007	5	2/6	Do. 5% Cum Pf.	5	5⅜— 5½
£230,000	Stk	6%	Do. Permanent 6% Debenture Stock, 1888 ..	100	141 —144
£200,000	Stk	5%	Auckland Electric Trams Co., Ltd., 5% 1st Mort. Deb. Stock, Red. ..	100	105½—106½
20,000	10	6/-	Barcelona Trams Co., Ltd., Ord. ..	10	9 — 10
10,000	10	5/-	Do. 5% Cum Pf. Shares	10	9 — 10
£46,300	100	5%	Do. 5% Debs., Red. ..	100	98 —101
£191,326	Stk	4½%	Do. 4½% Red. Deb. Stk.	100	91 — 96
75,606	1	—	Bath Elec. Trams. Ld., Pf. Or. ..	1	⅝— ¾
59,394	1	—	Do. 5% Cum. Pf. ..	1	$\frac{15}{16}$— 1$\frac{1}{16}$
75,000	5	—	Brisbane Electric Tram Investment Co., Ltd., Ord.	5	1½— 2½
75,000	5	2/6	Do. 5% Cum. Pf. ..	5	3¾— 4¼
£425,000	Stk	4½%	Do. 4½% 1st Deb. Stk., Red.	100	96 —101
£210,000	Stk	6%	Brit. Columbia Elec. Rly. Co., Ltd., Def. Ord. Stk.	100	100 —103*
£200,000	Stk	5%	Do. Pref. Ord. Stock	100	102 —105
7,500	10	5/-	Do. 5% Cum. Perp. Pf. ..	10	10¼— 10¾
£242,800	40	4½%	Do. 4½% 1st Mort. Debs. ..	40	102 ·104%
£220,000	100	4½%	Do. 4½% Vancouver Power Db.	100	97 —100
133,301	10	6/-	Brit. Electric Traction, Ltd., Ord.	10	9¾— 10¼
156,437	10	6/-	Do. 6% Cum. Pref.	10	11 — 11½
£1,000,000	Stk	5%	Do. 5% Perp. Deb. Stk. ..	100	116 —119
£250,000	Stk	4½%	Do. 4% 2nd Deb. Stk. Red. ..	100	94 — 97
100,000	5	1/6	Buenos Ayres & Belgrano Electric Trams, Ltd., Ord.	5	3$\frac{15}{16}$ 4$\frac{1}{16}$
40,500	5	3/-	Do. "A" 6% Cum Pref. ..	5	5½— 5¾
27,000	5	3/-	Do. "B" do.	5	5⅛— 5⅜
£320,000	Stk	5%	Do. 5% Deb. Stk., Red. ..	100	105 —108
£160,000	Stk	5%	Do. 5% 2nd Deb. Stk., Red.	100	102 —105
£200,000	Stk	5%	Buenos Ayres Elec. Trams Co. (1901) Ltd., 5% Db. Stk., Red.	100	96 — 99
£220,000	100	6%	Buenos Ayres Gd. Nat., Ltd., 6% 1st Deb. Bds.	100	95 —100
£150,000	100	5½%	Do. 5½% Pref. Debs.	100	100 —104
102,268	5	3/-	Calcutta Tramways Co., Ltd. .	5	7⅝— 7⅞
£350,000	Stk	4½%	Do. 4½% 1st Deb. Stk., Red.	100	106 —108
480,000	1	1/-	Cape Electric Tramways, Ltd. ..	1	1½— 1¾
40,000	5	2/6	City of Birmingham Trams Co., Ltd. 5 % Cum. Pref.	5	4½— 5
£300,000	100	4%	Do. 4% 1st Mort. Debs. ..	100	98 —101
155,000	5	4/-	City of Buenos Ayres Trams. Co., Ld.	5	10¼— 10½
£116,000	Stk	6%	Do. Per. 6% Deb. Stk. ..	100	140 —145
£120,000	Stk	5%	Colombo Elec. Tram. & Light. Co., Ltd., 5% 1st Mort. Deb. Stk. Red.	100	101 —104
60,000	10	6/-	Dublin United Trams. Co. (1896), Ltd., Ord. ..	10	13 — 14
59,987	10	6/-	Do. 6% Pref.	10	15 — 16
30,000	5	2/6	Isle of Thanet Elec. Trams. and Light. Co., Ltd., 5% Cum. Pref.	5	3¾— 4¼
£150,000	Stk	4%	Do. 4% Deb. Stock	100	90 — 93
125,000	10	5/-	London United Trams. (1901), Ltd., 5% Cum. Pref.	10	10⅝— 10⅞
£1,031,000	Stk	4%	Do. 4% 1st Mort. Deb. Stk. Red.	100	104 —106
£50,000	Stk	—	Madras Electric Trams (1904), Ltd., 5% Deb Stock, Red.	100	102 —105
314,016	1	—	Metropolitan Elec. Trams, Ltd., Def.	1	⅜— ½
500,000	1	6d.	Do. 5% Cum. Pref.	1	⅞— 1
£350,000	Stk	13/7	Do. 4½% Deb. Stock, Red.	100	102 —104
50,000	5	6/-	New General Traction Co., Ltd., 6% Cum. Pref.	5	½— 1½
110,923	8	2/9⅗	North Metropolitan Tramways Co. .	8	3¼— 3¾
£150,000	100	3½%	Do. 3½% Mort. Debs.	100	87 — 92
£196,200	Stk	5%	Perth Electric Trams, Ltd. (W.A.) 5% 1st Mort. Deb. Stock, Red. .	100	103 —106
24,500	10	10/-	Potteries Elec. Traction Co., Ld., Or.	10	8 — 9
24,500	10	5/-	Do. 5% Cum. Pref. ..	10	8½— 9½
£220,000	Stk	4½%	Do. 4½% Deb. Stk., Red.	100	99 —102*

IV.—ELECTRIC LIGHTING AND POWER.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
7,500	10	16/-	Bournemouth & Poole Elec. Sup. Co., Ltd., Ord. ..	10	11½— 12½
7,500	10	4/6	Do. 4½% Cum. Pref. ..	10	9½— 10
7,500	10	6/-	Do. 6% Cum. Second Pf. ..	10	11 — 12
£70,000	Stk	4½%	Do. 4½% Deb. Stock Red ..	100	104 —106¾
14,000	5	2/-	Bromley (Kent) Elec. Lt. & Pr. Co. Ld	5	5¼— 5
£50,000	Stk	4½%	Do. do. 4½% 1st Deb. Stk. Red.	100	100 —103
27,507	5	4/6	Brompton & Kensington Elec. Supply Co., Ltd. Ord. ..	5	10½— 11
12,493	5	3/6	Do. 7% Cum. Pref. Shares ..	5	10¼— 10¾
105,731	2	2/-	Brush Elec. Enging. Co., Ltd., Ord. .	2	¼— ½
150,000	2	2/4⅘	Do. 6% Pref.	2	1 — 1¼
£125,000	Stk	4½%	Do. 4½% Perp. 1st Deb. Stk. ..	100	93 — 96
£125,000	Stk	4½%	Do. 4½% Perp. 2nd Deb. Stk.	100	69 — 73
60,000	5	3/-	Calcutta Elec. Sup. Cor. Ltd., Ord ..	5	7¾— 8
£288,782	Stk	4%	Central Elec. Sup. Co., Ltd., 4% Gua. Deb. Stk. ..	100	106 —109
70,000	5	4/-	Charing Cross & Strand Elec. Sup. Corp., Ltd., Ord.	5	8½— 9
10,000	5	—	Do. do. Ord.	5	8 — 8½
80,000	5	2/3	Do. do. 4½% Cum. Pref. ..	5	5½— 5¾
£350,000	Stk	4%	Do. do. 4% Deb. Stk. Red.	100	103 —105
40,000	5	2/3	Do. do. "City Undertaking" 4½% Cum. Pref. ..	5	4¾— 5
40,000	5	2/3	Do. do. do. (1903) ..	5	4¾— 5
44,436	5	2/3	Chelsea Elec. Sply. Co., Ltd., Ord.	5	6¼— 6¾
£150,000	Stk	4½%	Do. do. 4½% Deb Stk., Red	100	108 —111
70,595	10	5/-	City of London El. Lghtg. Co., Ld., O.	10	10½— 11
40,000	10	6/-	Do. 6% Cum. Pref.	10	13 — 14
£400,000	Stk	5%	Do. 5% Deb. Stk., Red ..	100	123 —127
£300,000	Stk	4½%	Do. 4½% 2nd Deb. Stk., Red	100	103 —106
40,000	10	4/-	County of London Elec. Supply Co., Ltd., Ord.	10	9 — 10
30,000	10	6/-	Do. 6% Cum. Pref.	10	12 — 12½
£400,000	Stk	4½%	Do. 4½% Deb. Stk., Red. ..	100	106 —109
£250,000	—	4½%	Do. 4½% 2nd Deb. Stk., Prv. Crts. all paid, Red	100	101 —103
85,000	3	1/6	Crompton & Co., Ltd.	3	1½— 2
£100,000	—	5%	Do. 5% 1st Mort. Reg. Debs.	100	90 — 95
70,000	5	4/6	Edmundson's Elec. Cor. Ltd., Ord.	5	6⅛— 6⅜
70,000	5	3/-	Do. 6% Cum. Pref.	5	5⅞— 6⅛
£300,000	Stk	4½%	Do. 4½% 1st Mort. Db. Stk. Red	100	106 —108
£80,000	Stk	5%	Electric Lighting & Traction Co. of Australia, Ltd. 5% Deb. Stk. Red.	100	88 — 93
10,000	5	2/-	Folkestone Elec. Supply Co., Ld., O.	5	5½— 6
£50,000	Stk.	4½%	Do. 4½% 1st Deb. Stk., Red.	100	101 —104
15,000	10	—	Havana Electricity Co., Ltd.	10	9½— 10½
13,000	5	3/6	Hove Elec. Lighting Co., Ltd., Ord.	5	7½— 8
£50,000	Stk	4½%	Isle of Wight Electric Light & Power Co., Ltd. 4½% Deb. Stock, Red.	100	99 —101

Stocks and Shares marked * are quoted ex-dividend.

ELECTRIC LIGHTING AND POWER.—*Contd.*

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
150,000	1	—	Kalgoorlie Electric Power & Lighting Corp, Ltd., 6% Cum. Pref.	1	5/16 — 7/16
21,000	5	5/-	Kensington and Knightsbridge Electric Lighting Co., Ltd., Ord. ..	5	12 — 13
£135,000	Stk	4%	Kensington and Knightsbridge Electric Lighting Co., Ltd., and the Notting Hill Electric Lighting Co., Ltd., 4% Deb. Stock, Red.	100	102 —104
111,000	3	—	London Elec. Supply Corp., Ld., Ord.	3	2 — 2½
60,000	5	3/-	Do. 6% Pref.	5	5½— 6
£371,895	Stk	4%	Do. 4% 1st Mort. Db. Stk., Red	100	97 — 99
100,000	10	9/-	Metropolitan Elec. Sup. Co., Ld., Or.	10	16— 16½
76,121	5	2/3	Do. 4½% Cum. Pref.	5	5⅜— 5½
220,000	Stk	4½%	Do. 4½% 1st Mort. Db. Sk., Red.	100	112 —117
250,000	Stk	3½%	Do. 3½% Mort. Deb. Stk, Red.	100	96 — 99
£250 000	—	4½%	Midland Elec. Corp. for Power Distribution, Ld., 4½% 1st Mort. Deb.	100	93 — 96
10,852	10	6/-	Notting Hill Elec. Ltg. Co. Ltd. Ord.	10	14½— 15
£59,000	100	4%	Do. 4% 1st Mort. Debs. ..	100	101 —103
16,500	5	2/6	Oxford Electric Co. Ltd., Ord. ..	5	6 — 6¼
£50,000	Stk	4%	Do. 4% Debenture Stk. Red.	100	99 —101
£84,700	100	4½%	Royal Elec. Co. (of Montreal) 4½% 20-yr. 1st Mort. Deb	100	100 —102
40,000	5	5/-	St. James' & Pall Mall Elec. Light Co., Ltd. Ord.	5	14 — 15
20,000	5	3/6	Do. 7% Pref...	5	8½— 9
£150,000	Stk	3½%	Do. 3½% Deben. Stock, Red	100	98 —101
12,000	5	4/-	Smithfield Markets Elec. Supply Co., Ltd. Ord.	5	2¾— 3¼
£50,000	Stk	4%	Do. 4% Debenture Stk Red.	100	83 — 87
65,000	5	3/-	South London Elec. Sup. Co., Ltd. O.	5	4¼— 4½
100,000	1	—	South Metropolitan Elec Light & Power Co., Ltd. Ord.	1	⅞ — 1
50,000	1	8⅖d.	Do. 7% Cum. Pref.	1	1 5/16— 1 7/16
£100,000	Stk	4½%	Do. 4½% 1st Deb. Stock Red.	100	107 —110
50,000	5	2/6	Urban Electric Supply Co., Ltd., O.	5	4¾— 5
30,000	5	2/6	Do. 5% Cum Pref.	5	4 15/16 - 5 1/16
£200,000	Stk	—	Do. 4½% 1st Mort. Deb. Stk. Red	100	103 —105
110,000	5	6/6	Westminster Elec. Supply Corp. Ltd., Ord.	5	12½— 13½
28,151	5	2/6	Do. 5% Cum. Pref.	5	6¼— 6¾

V.—TELEGRAPH & TELEPHONE COMPANIES.

Present Amount Subscribed	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
£34,800	100	4%	African Direct Tel. Co., Ld., 4% Mt. Debs. (Series A), Red.	100	99 —102
25,000	10	—	Amazon Telegraph Co., Ld... ..	10	2½— 3½
£763,580	Stk	12/6	Anglo-American Tel. Co.. Ltd., Ord.	100	56 — 58
£3,118,210	Stk	25/-	Do. 6% Preferred Ordinary	100	103 —105
£3,118,210	Stk	2/-	Do. Deferred Ordinary ..	100	12⅝—12⅞
44,000	5	4/-	Chili Telephone Co., Ltd.	5	5⅝— 5⅞
$15,000,000	$100	$2	Commercial Cable Co., Capital Stk.	$100	170 —190
£1,903,856	Stk	4%	Do. Sterl. 500-yr 4% Deb. Stk., Red.	100	93 — 96
16,000	10	5/-	Cuba Submarine Tel. Co., Ld., Ord.	10	7¼— 7¾
6,000	10	10/-	Do. 10% Preference	10	14½—15½
6,000	5	5/-	Direct Spanish Telegraph Co., Ld., 10% Cum. Preference	5	7 — 8
£30,000	50	4½%	Do. 4½% Debs...	50	98—101%
60,710	20	3/-	Direct U.S. Cable Co., Ltd... ..	20	10⅝— 10⅞
£85,800	100	4½%	Direct West India Cable Co., Ltd., 4½% Reg. Debs.	100	100 —102
£300,000	100	4%	East. & S. African, Ld., 4% Mt. Db.	100	101 —103
£200,000	25	4%	Do. 4% Rg. Mt. Dbs. (Mauritius Subsidy) ..	25	100-102%
300,000	10	2/6	Eastern Extension, Australasia and China, Ltd...	10	12¾— 13
£602,400	Stk	4%	Do. 4% Mort. Deb. Stk., Perp.	100	105 —108
£4,000,000	Stk	25/-	Eastern Tele. Co., Ltd., Ord. ..	100	133 —136
£2,000,000	Stk	17/6	Do. 3 % Pref.	100	88 — 90
£1,836,814	Stk	4%	Do. 4% Mort. Deb.	100	105 —107
150,000	10	5/-	Great Northern Telegraph Co., Ltd., (of Copenhagen) ..	10	28½—29
£58,700	100	4½%	Halifax and Bermudas Cable Co., Ltd., 4½% 1st. Mort. Debs. Red.	100	100 —102
17,000	25	12/6	Indo-European Tele. Co., Ltd. ..	25	44 — 47
72,680	1	7⅕d.	Monte Video Telephone Co., Ltd., O.	1	9/16— 11/16
£1,983,333	Stk	6%	National Telephone Co., Ltd., Pref.	100	105 —108
£1,966 667	Stk	5%	Do. Deferred	100	96 — 98
15,000	10	6/-	Do. 6% Cum. 1st Pref. ..	10	13 — 14
15,000	10	6/-	Do. do. 2nd do. ..	10	12 — 13
250,000	5	2/6	Do. 5% Non-Cum. 3rd Pref.	5	5¼— 5⅜
£2,000,000	Stk	3½%	Do. 3½% Deb. Stk., Red. ..	100	97 — 99
£689,593	Stk	4%	Do. 4% do. do. ..	100	104 —106
£1,000,000	—	5/9	Do. 4% Prov. Certs. 35% to be paid..	—	67½— 68½
179,313	1	7⅕d.	Oriental Telephone & Elec. Co., Ltd.	1	15/16— 1 1/16
50,000	1	7⅕d.	Do. 6% Cum. Pref.	1	1⅛— 1¼

TELEGRAPHS AND TELEPHONES.—*Contd.*

Present Amount Subscribed,	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
£100,000	100	4%	Pacific & European Tel. 4% Guar. Debs. Red...	100	97 —100
11,839	8	4/-	Reuter's Telegram Co., Ltd. ..	8	6½— 7½
58,000	5	5/-	United River Plate Telep. Co., Ltd.	5	6¼— 6¾
40,000	5	2/6	Do. 5% Cum. Pref.	5	5 — 5¼
£179,947	Stk	5%	Do. 5% Deb. Stock, Red. ..	100	103 —106
15,609	10	6/-	W. African Telegraph Co., Ltd. ..	10	6½— 7½
30,008	2½	—	West Coast of America, Ltd. ..	2½	⅛— ¼
£150,000	100	4%	Do. 4% Deb. Guar. by West. Tel.	100	97 —100
88,321	10	6d.	W. India & Panama Teleg. Co., Ld., Or.	10	⅝— ¾
34,563	10	6/-	Do. 6% Cum. 1st. Pref. ..	10	7⅛— 7⅝
4,669	10	6/-	Do. 6% Cum. 2nd Pref. ..	10	5 — 6
£80,000	100	5%	Do. 5% Deb.	100	102 —104
207,930	10	5/-	Western Telegraph Co., Ltd. ..	10	13 — 13¼
£75,000	100	5%	Do. 5% Debs., 2nd Series, 1906	100	101 —104
518,915	Stk	4%	Do. 4% Deb. Stock, Red. ..	100	101 —104

VI.—SHIPPING COMPANIES.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
32,500	10	5/6	Anchor Line (Henderson Bros.), Ltd., 5½% Cum. Pref.	10	8 — 8½
£325,000	Stk	4½%	Do. 4½% Red. 1st Mort. Deb. Stk.	100	97 — 99
£672,900	Stk	4½%	British & African Stm. Nav. (1900, Ltd., 4½% 1st Mort. Deb. Stk.. Red.	100	93 — 95
40,000	10	5/6	Bucknall Steamship Lines, Ltd., 5½% Cum. Pref.	10	6 — 7
£600,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk.	100	75 — 78
£750,000	Stk	4½%	Clan Line Steamers, Ltd., 4½% Deb. Stk. Red. ..	100	98 —100
60,000	20	16/-	Cunard Steam Ship Co., Ltd., Nos. 1-60,000 ..	20	13 — 13½
40,000	20	8/-	Do. Nos. 60,001-100,000	10	5¾— 6¼
£464,430	Stk	4½%	Elder Dempster Shipping, Ltd., 4½% 1st Mort. Deb. Stk. ..	100	97 — 99
1,200,000	1	6d.	Furness, Withy & Co., Ltd., Ord...	1	1 — 1¼
30,000	10	5/-	Do. 5% Cum. Pref.	10	9½— 10
327,300	100	4½%	Do. 4½% 1st Mort. Debs. Red.	100	105 —107
25,328	7½	4/7	Gen. Steam Navigation Co., Ld., Ord.	7½	4 — 4½
36,758	8	4/9⅗	Do. Non-Cum. 6% Pref.	8	6¾— 7¼
£150,000	Stk	4%	Do. 4% 1st Mort. Deb. Stk. Red.	100	95 — 97
55,000	5	1/3	Houlder Line, Ltd., Ord.	5	3 — 3½
40,000	5	2/9	Do. 5½% Cum. Pref.	5	3½— 4
£200,000	Stk	4½%	Do. 4½% 1st Mt. Deb. Stk. Red.	100	85 — 88
141,500	10	5/-	Leyland (Fredk.), & Co.. (1900), Ltd., 5% Cum. Pref. ..	10	3½— 4
£1,160,000	Stk	5 %	Peninsular and Oriental Steam Nav. Co., 5% Cum. Pref. ..	100	127 —130
£1,160,000	Stk	7 %	Do. do. Deferred ..	100	212 —215
£800,000	Stk	3½%	Do. do. 3½% Deb. Stock..	100	99 —101
£648,100	Stk	3½%	Do. do. 3½% 2nd Deb. Stk.	100	96 — 98
15,000	100	30/-	Royal Mail Steam Packet Co. Ord..	60	18 — 20
39,075	5	2/6	Shaw, Savill & Albion, Ltd., 5% Cum. "A" Pref..	5	4¾— 5¼
39,075	5	2/6	Do. "B" Ord...	5	4 — 4½
141,841	10	4/-	Union Castle Mail Steamship Co., Ltd., Ord..	10	8¼— 8¾
24,000	10	4/6	Do. 4½% Cum. Pref... ..	10	9¾— 10¼
£1,008,894	Stk	4%	Do. 4% Debenture Stk., Red.	100	100 —102

VII.—MISCELLANEOUS COMPANIES.

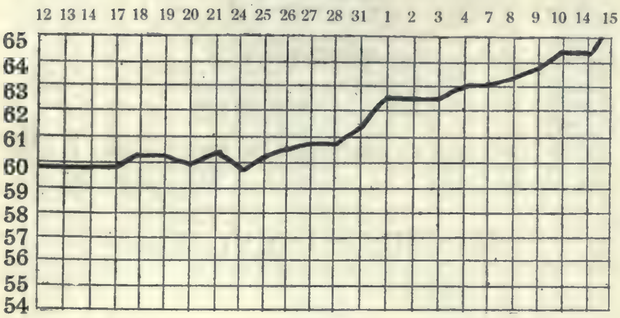
Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up,	Closing Prices.
60 000	1	9⅗d.	Chadburn's (Ship) Tele. Ltd., Ord...	1	⅞— 1⅛
£750,000	Stk	5%	General Hydraulic Power Co., Ltd.	100	135 —140
12,500	10	10/-	Oakey (John) and Sons, Ltd., Ord..	10	24 — 26
10,000	10	6/-	Do. do. 6% Cum. Pf.	10	14 — 15
183,538	1	7·9d.	Power Gas Corp., Ltd., Ord., Nos. 66,463-250	15/-	5/16 — 7/16
66,462	1	1/-	Do. do. Nos. 1 66,462	1	9/16— 11/16
284,524	10	7/-	United Alkali Co., Ltd., 7% Cm. P.	10	8 — 8½
£2,691,560	Stk	5 %	Do. 5% Mort. Deb. Stk., Red.	100	101 —103
135,000	1	1/3⅗	Waygood (R.) & Co., Ltd., Ord. ..	1	1⅛ — 1¼
135,000	1	7⅕d.	Do. 6% Cum. Pref. ...	1	1 — 1¼
33,500	5	2/6	Webley & Scott Revolver & Arms Co., Ltd.	5	⅜— ⅝
33,500	5	2/6	Do. 5% Cum. Pref. ..	5	2¼— 2¾
743,975	1	7½d.	Welsbach Incandescent Gas Light Co., Ltd., Ord.	1	9/16— 11/16
600,000	1	9.08d.	Do. 6% Cum. Pref.	1	13/16— 15/16
£82,211	Stk	5½%	Do. 5½% Deb. Stk. Red. ..	100	99 —101

Stocks and Shares marked * are quoted ex-dividend.

THE HOME METAL MARKET.

Showing Daily Fluctuations from October 12th to November 15th.

COPPER.



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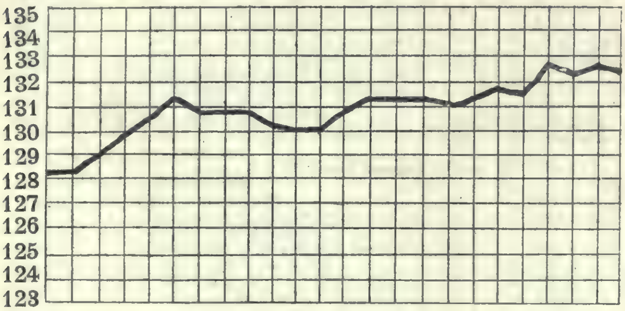

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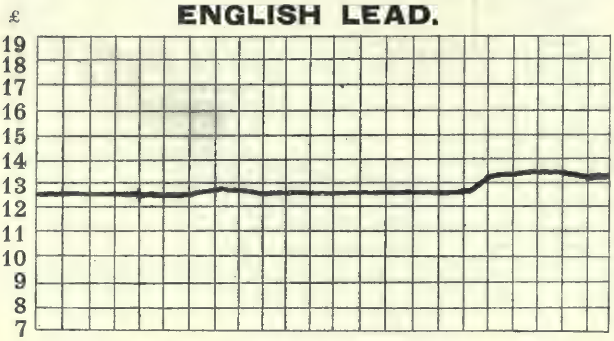

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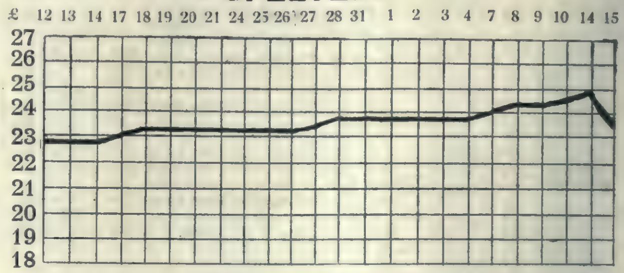

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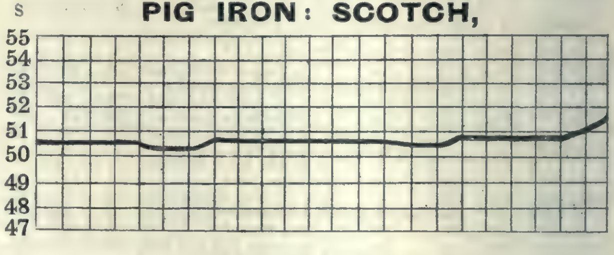

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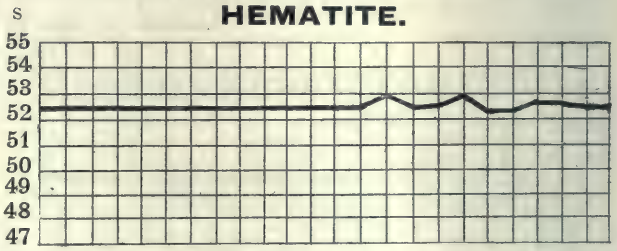

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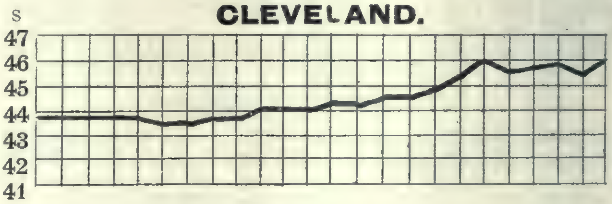


OPENINGS FOR TRADE ABROAD.

British India.

The directors of the Great Indian Peninsula Railway are prepared to receive tenders up to the 17th inst., for the supply of the following stores: Platelayers' tools, etc.; galvanised corrugated sheets; steel and iron work for bridges; fencing materials; stationery, etc.; lamp glasses, etc.; steel and iron work for footbridge; signal wire posts and pulleys.

Specifications and forms of tender may be obtained at the Company's offices, 48, Copthall Avenue, E.C., on payment of the fee for specification.

Mexico.

The development of the mining industry is creating a demand for high-pressure centrifugal pumps capable of pumping water from depths of between two and three hundred metres. The sale of these pumps, which have only recently been introduced, was at first monopolised by certain Swiss manufacturers; but these have sold their patents to manufacturers in the United States, which country now furnishes all the high-pressure centrifugal pumps used in the principal mines.

PRICES CURRENT OF COAL, IRON, STEEL, AND OTHER METALS.

MANUFACTURERS' AND MERCHANTS' QUOTATIONS.

MARKET REPORT.

Wednesday, November 16th, 1904.

THE dominant feature of the metal market has been the strong upward movement in copper, and prices have touched a record for the year. The centre of gravity now lies in the United States, where the cessation of the Presidential campaign has resulted in a larger distribution of orders to manufacturers. The Amalgamated Company, being the only producers who still command material for early delivery, have had to bear the brunt of this buying rush, which has become so extensive as to reveal the fact that even the Amalgamated concern are no longer in a position to sell any more Electro Copper for delivery before February of next year. This has not been generally known long enough to make its full effect felt upon the trade, but in some quarters the possibilities of the situation are being recognised, and the danger of an actual scarcity of metal is, states Messrs. Merton and Co.'s report, beginning to be reckoned with.

Dealings in iron and steel have broadened out, The indications, too, are favourable for a further development of the market, inasmuch as purchases of pig iron have been made for account of American consumers, who will probably require the iron to be shipped to the States. The tendency of prices is in the upward direction and in spite of an increased production, stocks have again diminished. The home trade is distinctly mending.

Spelter has been strong on restricted supplies, and producers are sold out for months to come. A new feature in this section is the demand from the East. With the American market ahead of values, too, a fresh rise in prices on this side is inevitable.

Lead has advanced on good buying, and there is a strong undertone in the market which presages a further rise. Supplies are short.

Dealings in tin has been on a small scale and prices are inclined to weaken. Antimony is rather firmer.

In the coal trade prices have favoured buyers. The feature in chemicals has been the increase of the export trade. The timber market has improved both in respect of the volume of business and prices.

IRON, STEEL, PIG-IRON, &c.

SCOTLAND.

Messrs. David Colville and Sons, Ltd., Dalzell Steel and Iron Works, Motherwell, N.B., quote as follows. Prices delivered in Glasgow or equal :—

Steel:	£	s.	d.
Siemens' Steel Plates, Marine Boiler Quality	6	15	0
,, ,, ,, Land ,, ,,	6	17	6
,, ,, ,, Ship Quality Plates	5	12	6
Siemens' Steel Bars, Boiler Quality	6	10	0
,, ,, ,, Ship ,,	6	0	0
,, ,, Angles	5	0	0

Manufactured Iron:

Bars—Dalzell	5	17	6
,, Best	6	7	6
,, ,, Horseshoe	6	7	6
,, Angle	5	17	6
,, Best Angle	6	7	6
,, Best Best	6	17	6
,, Extra Best	7	7	6

Usual terms and extras. Special rates for delivery in England and export. The above prices subject to alteration without notice.

The Glasgow Iron and Steel Co., Ltd., Wishaw, quote as under (prices are delivered Glasgow or equal) :—

	£	s.	d.	
Steel Angles (Glasgow Crown Steel)	5	0	0	per ton.
Steel Ship Plates (Glasgow Crown Steel)	5	12	6	,,
Steel Bars, Ship Quality (Glasgow Crown Steel)	6	5	0	,,
Steel Bars, Boiler Quality (Glasgow Crown Crown Steel)	6	15	0	,,
Steel Land Boiler Plates (Glasgow Crown Crown Steel)	6	5	0	,,
Steel Marine Boiler Plates (Glasgow Crown Crown Steel)	6	5	0	,,

Less 5 per cent. discount. Extras as per standard list.

Special prices for delivery in England and for export. The above prices subject to alteration without notice.

John Spencer (Coatbridge), Ltd., Phœnix Ironworks, Coatbridge, N.B., quotes :—

	£	s.	d.
Bars—Phœnix	6	0	0
,, Best	6	10	0
,, Best Best	7	0	0
,, Extra Best	7	10	0
,, Best Horse Shoe	6	10	0
,, Extra B.H.S.	7	10	0
,, Extra Best Cable	8	0	0
,, Rivet	6	0	0
,, Best Scrap Rivet	7	0	0

	£	s.	d
Angles—Phœnix	6	0	0
,, Best	6	10	0
,, Extra Best	7	0	0
Gas Tube Hoops—Phœnix Best	6	10	0
Plates—Phœnix	—		
,, Best Boiler	7	5	0
,, Best Best Boiler	7	15	0
,, Extra Best Boiler	8	15	0
Boiler Tube Strips—Phœnix Best Best	7	15	0

All per ton, delivered f.a.s., Glasgow, Greenock, Grangemouth, Granton, Leith, or Ardrossan. 5 per cent. discount cash monthly.

Messrs. R. Feldtmann and Co., of Glasgow, quote (Commission extra).

Pig Iron:	No. 1. £	s.	d.	No. 3. £	s.	d
Coltness, f.a.s. Glasgow	3	3	6	2	13	0
Gartsherrie ,,	2	16	0	2	11	0
Summerlee ,,	2	17	0	2	11	0
Carnbroe ,,	2	12	6	2	9	6
Langloan ,,	3	4	0	2	14	0
Calder ,,	2	18	0	—		
Clyde ,,	2	16	0	2	10	6
G.M.B. ,,	—			—		
Glengarnock, f.o.b. Ardrossan	2	17	0	2	11	0
Eglinton ,, ,,	2	11	3	2	9	0
Dalmellington, ,, Ayr	2	11	9	2	9	9
Shotts ,, Leith	2	17	6	2	11	6

NORTH OF ENGLAND.

Messrs. W. Whitwell and Co., Ltd., Thornaby Ironworks, Stockton, quote as follows, **at works:—**

	£	s.	d.
W.W. Crown Bars	6	7	6
W.W. Best Bars	6	17	6
W.W. Best Best	7	7	6
W.W. Best Best Best	7	17	6
W.W. Best Shoe	6	17	6
Thornaby Crown	7	17	6
Thornaby Best	8	7	6
Thornaby Best Best	9	7	6
Whitwell Special Admiralty Cable	10	0	0
Special Chain Iron	9	0	0
Tube and Nail Strips	6	12	6
W.W. Crown Angle Iron	6	10	0
W.W. Best Angle Iron	7	0	0
Tee Iron, to 8-inches United	7	7	6

Terms, Cash, less 2½ per cent. discount on 10th of month following delivery.

LANCASHIRE.

The Pearson and Knowles Coal and Iron Company, Ltd. Dallam and Bewsey Forges, Warrington, quote:—

	Iron. £	s.	d.	Steel. £	s.	d.
Crown (BNF) Bars	6	10	0	7	0	0
,, ,, Angles	7	0	0	7	10	0
,, ,, Tees	7	10	0	8	0	0
,, (WIW) Hoops	7	0	0	7	10	0
,, ,, Sheets	7	10	0	8	0	0

Ordinary Sizes, F.A.S. Liverpool in 10-ton Lots.
Extras for Sizes and Cutting as per List.
Lots under 5 cwts. of a Size 10/- per ton extra.

WORCESTERSHIRE.

Baldwins Ltd. (with which is amalgamated Knight and Crowther, Ltd.), Wilden Works, near Stourport, quote:—

Black Sheets:	Singles 20 G 96in. by 36in. per ton. £	s.	d.	Doubles 21 G to 24 G 96in. by 36in. per ton. £	s.	d.
"Vale"	10	0	0	10	0	0
"Shield"	10	10	0	11	10	0
"Severn"	11	10	0	12	10	0
Baldwin Wilden B.	12	10	0	13	10	0
Charcoal	16	10	0	17	10	0
Best Charcoal	18	10	0	19	10	0

Pickled cold-rolled and close annealed sheets specially quoted for.

Extra widths, Singles to 66in., Doubles to 56in., Lattens to 46in. Extra lengths, Singles to 168in., Doubles to 132in., Lattens to 108in.

Tinned Sheets:	To 108 by 36in. £	s.	d.	To 96 by 36in. £	s.	d.
Best Coke (Finish)	28	0	0	29	10	0
,, Charcoal (Finish)	30	0	0	31	10	0
Extra ,, ,,	32	0	0	33	10	0

Cotton Can Tin Sheets to 39in. by 36in. specially quoted for.
Tin Plates, Best Charcoal, £1 7s. 0d. per ton.
Best CR and CA Sheets, 24 G, £10 10s. 0d. per ton.

Patent Coated Sheets:	£	s.	d.	£	s.	d.
No. 3 Lead	13	10	0	14	10	0
S.V. Lead	15	0	0	16	0	0
No. 3 Terne	15	0	0	16	0	0
S.V. Terne	16	10	0	17	10	0

Extreme sizes in Tin and Patent Coated specially quoted for.

Lattens up to 36 by 27 W.G. £1 10s. 0d. per ton extra throughout for all brands.

At works less 2½% for cash monthly, 10th inst.

Galvanized Corrugated Sheets:

	£	s.	d.	
"Phœnix" Brand, 24 G., f.o.b. London, in Bundles	11	10	0	per ton.
"Blackwall" Brand, 26 G., in felt-lined cases for Australia, f.o.b. London	14	0	0	,,

Galvanized Working Up-Sheets:

	£	s.	d.	
24 G., f.o.b. London, in Bundles	13	10	0	per ton.

WALES.

Cordes (Dos Works), Ltd., of Newport, Mon., quote "Star" brand patent wrought nails, steel nails, &c.

Discounts—

45 per cent. off 1-inch to 3-inch strong rose and all fine rose and 6dy. and 8dy. pound.

40 per cent. off 3½ inch to 7-inch strong rose and 10dy. and 20dy. pound.

40 per cent. off all sharp-pointed nails.

Delivered in lots of 2 cwt. and upwards. Extra 2½ per cent. discount off the gross on two tons and upwards.

Steel rose, flat points, 5-inch to 7-inch basis:—
2 tons 9/3 per cwt. } d/d any Railway Station.
Under 2 tons 9/6 per cwt. }
Steel cut nails, 3-inch basis—
2 tons 8/- per cwt. } d/d any Railway Station.
Under 2 tons 8/3 per cwt. }
Slit rods (iron) £7 10s. per ton, at works for 2-ton lots.

Messrs. Richard Thomas and Co., Ltd., of 3, Love Lane, Eastcheap, E. C. — Works: South Wales, Burry, Lydney, Lydbrook, and Cwmbwrla, quote:—

	Per Box. f.o.b. Wales. £	s.	d.
Coke Tin-plates.			
C 18¾ by 14 124s. 110 lb. "BV"	0	12	6
C 20 by 10 225s. 155 ,, "Jumbo"	0	17	6
C 20 by 14 112s. 108 ,, "Lydbrook"	0	12	0
C 28 by 20 112s. 216 ,, "Lydbrook"	1	4	3
Charcoal Tinplates:			
C 20 by 14 112s. 108 lb. "Allaway"	0	12	9

BELGIUM.

C. L. Faulkner, Suffolk House, Laurence Pountney Hill, London, E.C., quotes:—

Prices quoted are in £ stg. and per ton of 1,015 kos. (2,240 lb.) delivered free on board ANTWERP for approved quantities.

Steel:		£	s.	d	
Basic Bars	at	4	15	0	per ton.
,, Angles	at	4	16	0	,,
,, Tees	at	4	19	0	,,
,, Joists	at	4	7	6	,,
Billets........................	at	3	12	0	
Sheet Bars	at	3	14	0	,,
Heavy Rails	at	4	0	0	,,
Light Rails	at	4	16	0	,,
Finished Steel:					
Fencing Standards	at	4	19	6	per ton.
Shoeing Bars........................	at	5	2	6	,,
Tyre Bars	at	5	4	0	,,
Half-Round Bars	at	5	2	6	,,

Structural Steelwork. Prices on application.

METALS.

Messrs French and Smith, 147, Leadenhall Street, and 11, Oldhall Street, Liverpool, quote:—

TIN.

Tin:	£	s.	d.		£	s.	d.	
English f.o.b. Ingots...... Dis. 1¼%	133	10	0	to	134	0	0	per ton.
London or Liverpool Bars —4 cwt. Barrels...... Dis. 1¼%	134	10	0	to	135	0	0	,,
Straits Warehouse net cash	132	10	0	to	132	12	6	,,
London 3 months fixed	131	17	6	to	132	0	0	,,
Warehouse, London:—								
Australian net cash	132	10	0	to	133	10	0	,,
Banca ,, ,, ...	133	0	0	to	133	10	0	,,
Billiton ,, ,, ...	132	15	0	to	133	0	0	,,

COPPER.

Copper:	£	s.	d.		£	s.	d.	
Ore	0	11	0	to	0	12	0	per unit.
Regulus, Matte and Precipitate	0	12	3	to	0	12	10	,,
Chili Bars G.M.B. Cash 2½%	66	15	0	to	66	16	3	per ton
Swansea, Liverpool, or London 3 months fixed	67	5	0	to	67	7	6	,,
Australian in Warehouse, London, P. C. C. Burra Cake, Wallaroo Cake......	Nominal.							
Other Brands 2½%.........	68	0	0	to	69	10	0	,,
English f.o.b.								
Tough Cake 2½%	68	0	0	to	68	10	0	,,
,, Ingot	68	0	0	to	68	10	0	,,
Best Selected 2½%	68	15	0	to	69	10	0	,,
Sheets, Sheathing and Rods 2½%.........	77	0	0	to	78	0	0	,,
Sheets, 4 by 4 feet for India 2½%	73	0	0	to	74	0	0	,,

YELLOW METAL.

Yellow Metal:	£	s.	d.	£ s. d.	
Sheets, 4 by 4 feet for India 2½%	0	0	6⅝	———	lb.
f.o.b. Sheathing 2½ %......	0	0	6¾	———	,,

SPELTER.

	£	s.	d.		£	s.	d.	
Silesian, Net cash at outports	24	15	0	to	25	0	0	per ton.
Special Silesian, at outports	25	5	0	to	25	10	0	,,
British, Net cash at London	24	10	0	to	25	0	0	,,
Blende of 50 %	6	6	6					,,
Calamine.......	6	10	0					,,

LEAD.

	£	s.	d.		£	s.	d.	
English Pig, 2½ %, at works, London, Liverpool or Swansea	13	5	0	to	13	7	6	per ton.
Spanish, 2½ %, ex ship, Bristol, Liverpool, Newcastle, Swansea, etc.	13	0	0	to	13	2	6	,,
Lead Ore of 70 %	6	10	0					,,

ANTIMONY.

	£	s.	d.		£	s.	d.	
Star Regulus	28	0	0	to	28	10	0	per ton.
Ore (50 % good quality and produce)	6	0	0	to	7	0	0	,,
Crude	9	0	0	to	10	10	0	,,

QUICKSILVER.

	£	s.	d.
Spanish, per flask containing 75 lb	7	15	0
Italian ,, ,, ,, ,, ...	7	14	0

COAL,

LEICESTERSHIRE.

The Nailstone Colliery Company, Leicester, quote. Price per Ton at Pit of 20 Cwt., with ½ Cwt. per Ton for wastage:—

Upper Main Seam.	s.	d.
Main Coal	8	6
Best Hard Steam (hand picked, as used by the Railway Companies)	7	6
Best Hard Steam Cobbles (made through 6 in. mesh, free from slack)	7	0
Main Slack	4	6

Terms, net cash on 10th of month following delivery.

DERBYSHIRE.

The Manners Colliery Co., Ltd., of Ilkeston quote as follows, per ton at pit:

Kilburn Coal:	s.	d.
Best London Brights	9	6
Large Nuts (1½ to 3¼)	9	6
Small Nuts (¾ to 1½)	6	0
Rough Brights	6	0
Peas (⅜ to ¾)	5	0
Slack	3	6
Smudge	2	0

Low Main (or Tupton) Coal:		
Low Main Brights	7	6
,, ,, Nuts	7	3
Hards (Good Steam Coal)	8	0
Bakers' Nuts (1″ to 2″)	6	6
Slack	3	6

The Clay Cross Company's Collieries, Clay Cross, near Chesterfield, quote:—

	per ton at pit. s.	d.
Best Main Coal.—Best Coal, brown ash, leaving very little residue, cheerful and lasting	10	6
Best Silkstone.—Brown ash, useful bagging size	10	0
Best Selected Tupton Brights.—Hand picked large Coal, of first-rate quality	9	0
Best Treble Screened Cobbles.—Through 5½-in. square mesh shaker screen, and over 2½ inch bar. Free from slack. Nice bagging size	7	9
Best Cobbles.—Good size, hot, durable, suitable for Steam work	7	3
Best Picked Hards.—A first rate Hard Steam Coal, large, giving intense heat	8	3

NOTTINGHAMSHIRE.

The Digby Colliery Co., Ltd., near Nottingham, quote per ton at pit:—

Digby Coal:

Steam.	s.	d.
Best Hand Picked Hard	9	0
Steam Hard	7	9
Hard Nuts	7	0

Gedling Colliery.

Steam.		
Top Hard Best	9	0
,, Hard Steam	8	0
,, ,, Cobbles	7	0

CHEMICALS AND OIL.

CHEMICALS.

Messrs. S. W. Royse and Co., Albert Square, Manchester, quote:

	£	s.	d.	
Acids: Oxalic	0	0	2½	per lb.
Picric, Crystals	0	0	11	,,
Tartaric ... at Manchester	0	0	11	,,
Acetate of Lime: Brown at Manchester net	8	10	0	per ton.
Grey ,, —	11	10	0	,,
Alumina: Alum, Lump, loose	5	5	0	,,
,, ,, in casks	5	7	6	,,
,, Ground, in bags	5	15	0	,,
Sulphate of Alumina, 14%	4	10	0	,,
Ammonia: Carbonate	0	0	3⅝	per lb.
Muriate Grey f.o.b. Liverpool	23	10	0	per ton.
Sal-ammoniac, Lump, 1sts, del^d. U.K.	42	0	0	,,
,, ,, 2nds, ,,	40	0	0	,,
Sulphate ... f.o.b. Liverpool	12	12	6	,,
Arsenic: Best White Powdered ... net	12	5	0	,,
Bleaching Powder, 35% ... ,,	4	2	6	,,
Borax: British Refined Crystal ... ,,	12	0	0	,,
Coal Tar Products:				
Benzole, 50/90 % ... ,,	0	0	7	per gal.
,, 90% ... ,,	0	0	9	,,
Carbolic Acid Crystals, 34/35° C. ... ,,	0	0	5¾	per lb.
,, ,, ,, 39/40° C. ... ,,	0	0	6	,,
,, ,, Liquid, 97/99 % ... ,,	0	0	9	per gal.
,, ,, Crude, 62½ % at 60° F. f.o.b. ,,	0	2	1	,,
Creosote, ordinary good liquid ... ,,	0	0	1⅝	,,
Naphtha, Crude, 20 % at 120° C. ... ,,	0	0	3	,,
,, Solvent, 90% at 160° C. f.o.b ,,	0	0	8	,,
,, ,, 95 % at 160° C. ,, ,,	0	0	9	,,
,, ,, 90 % at 190° C. ,, ,,	0	0	10½	,,
,, Rectified, flash point over 73° F. ... f.o.b. ,,	0	0	10½	,,
,, Rectified, flash point over 100° F. ... f.o.b. ,,	0	0	10½	,,
Naphthalene, all qualities.				
Pitch ... f.a.s. Manchester. ,,	1	12	0	per ton.
Copperas: Green, in bulk ... ,,	0	12	6	,,
,, barrels f.o.b. L'pool ,,	2	0	0	,,
Cake ... ,,	1	2	6	,,
Copper: Sulphate	21	5	0	,,
Cyanides: 98% minimum ... f.o.b. net	0	0	7½	per lb.
Lead: Acetate (Sugar) White, English	27	10	0	per ton.
,, ,, ,, Foreign c.i.f. U.K	23	10	0	,,
,, ,, Grey	21	0	0	,,
,, ,, Brown at Manchester	15	15	0	,,
Nitrate	22	10	0	,,
Litharge, Flake	15	0	0	,,
,, Powder	15	10	0	,,
Red Lead, Genuine, c.i.f. London less 5%	14	10	0	,,
White ,, ,, Dry ,, ,, ,,	16	0	0	,,
Naphtha (Wood): Miscible, 60 o.p.	0	2	10	per gal.
Solvent	0	2	7	,,
Potash: Bichromate ... delivered England ...	0	0	3	per lb.
Carbonate, 90/92 % ... c.i.f Hull ...	18	0	0	per ton.
Caustic, 75/80 % ... ,, ,, ...	20	0	0	,,
Chlorate ... net	0	0	$3\frac{1}{16}$	per lb.
Montreal ... in Store, Liverpool	35	0	0	per ton.
Prussiate, Yellow ... net	0	0	$4\frac{15}{16}$	per lb
Soda: Ash, Caustic, 48 %, Ordinary ... ,,	5	5	0	per ton.
,, ,, ,, Refined ... ,,	6	5	0	,,
,, Carbonated, 48 % ... ,,	5	10	0	,,
,, ,, 58 % (Ammonia Alkali) ... net	4	10	0	,,
,, Bleachers' Refined Caustic 50/52 % ... net	6	10	0	,,
Caustic, White, 77 % ... ,,	10	10	0	,,
,, ,, 70 % ... ,,	9	12	6	,,
,, ,, 60 % ... ,,	8	12	6	,,
,, Cream, 60 % ... ,,	8	10	0	,,
Crystals, in bags	3	0	0	,,
,, barrels	3	7	6	,,
Acetate ... c.i.f. Hull net	16	0	0	,,
Bicarbonate, in 1 cwt. kegs	6	15	0	,,
Bichromate ... delivered England ...	0	0	2¼	per lb.
Chlorate ... net	0	0	$3\frac{1}{16}$	per lb.
Nitrate ... ex quay Liverpool, ... ,,	10	12	6	per ton.
Phosphate	9	5	0	,,
Prussiate ... net	0	0	3⅝	per lb.

	£	s.	d.	
Soda: Silicate, Solution, 140° Tw.	4	10	0	per ton.
Sulphate (Glauber Salts)	1	12	6	,,
,, (Saltcake, 95%)	1	15	0	,,
Sulphur: Recovered	4	15	0	,,
Roll	6	15	0	,,
Flowers	7	10	0	,,
Zinc: Sulphate	6	15	0	,,

MINERALS.

	£	s.	d.	
Barytes: Lump Carbonate, 90/92%	3	10	0	,,
Sulphate, No. 1, White	2	15	0	,,
China Clay: of various qualities for all purposes; prices from about 11/- to about 30/- per ton, f.o.b. Cornwall: stocks also kept at Runcorn and Preston. Quotations given carriage paid.				
Chrome Ore: Basis 50% c.i.f. British Ports	3	7	6	,,
Manganese: Lump c.i.f. Liverpool 10½d.				per metallic unit.
Ochre: French JC .... f.o.b. Rouen, net	2	5	0	per ton.
,, JF	5	10	0	,,
Talc: (French Chalk).........c.i.f. Liverpool	3	10	0	,,

OILS, etc.

	£	s.	d.	
Aniline Oil ....net	0	0	4¾	per lb.
,, **Salt** .... ,,	0	0	4½	,,
Castor Oil: French, 1st pressure, f.o.b. Marseilles less 1¼%	20	0	0	per ton.
English, 1st pressure, f.o.r. Hull, less 2½%	20	2	6	,,
Cocoa Nut Oil: Ceylon, ex store Manchester........net	31	10	0	,,
Cochin, ex store Manchester........net	33	0	0	,,
Cotton Seed Oil: Refined at Hull, less 2½% naked	15	0	0	,,
Edible...at Hull, less 2½% naked	15	10	0	,,
Glycerine: Crude, 80% .... net	31	0	0	,,
Linseed Oil: Raw... ..at Hull, less 2½% naked	13	15	0	,,
Boiled......at Hull less 2½% naked	14	15	0	,,
Starch: American Pearl...at Manchester, net	8	10	0	,,
Dextrine........ ,, ,,	17	10	0	,,
Farina........ ,, ,,	15	10	0	,,
Turpentine: American.........at Liverpool	39	15	0	,,
Russian ....at Hull...net	20	0	0	,,

TIMBER.

Messrs. Alfred Dobell and Co., Liverpool, quote:—

COLONIAL WOODS.

Timber.

		£	s.	d.		£	s.	d.
Quebec Square White Pine...	per cub. ft.	0	1	9	to	0	3	0
Quebec Waney Board Pine...	,,	0	2	8		0	3	9
St. John Pine, 18 in. average	,,	0	2	3		0	3	3
Lower Ports Pine	,,	0	1	1		0	1	6
Quebec Red Pine	,,	0	1	6		0	1	10
Quebec Oak, 1st quality	,,	0	2	9		0	3	3
Quebec Oak, 2nd quality	,,	0	1	6		0	2	6
Ash	,,	0	1	6		0	2	3
Elm	,,	0	3	0		0	3	6
Hickory	,,	0	2	0		0	2	6
Quebec Birch	,,	0	1	6		0	2	3
St. John Birch	,,	0	1	6		0	2	0
Birch Planks	,,	0	0	9		0	0	11
Spruce Spars	,,	0	0	10		0	1	0

Deals.

		£	s.	d.		£	s.	d.
1st quality Quebec Pine	per std.	22	10	0	to	32	10	0
2nd do. do.	,,	17	0	0		22	0	0
3rd do. do.	,,	11	10	0		13	0	0
St. John, N.B., etc., Spruce	,,	6	10	0		6	15	0
Lower Ports Spruce	,,	6	0	0		6	10	0
Spruce Boards	,,	5	10	0		6	0	0
Lathwood	per fathom	3	12	6		4	0	0

UNITED STATES, etc., WOODS.

Pitch Pine.

		£	s.	d.		£	s.	d.
Hewn	per cub. ft.	0	1	3	to	0	1	8
Sawn	,,	0	0	10		0	1	6
Planks, Stowage	,,	0	0	10		0	1	0
Boards, Prime	per std.	12	10	0		16	0	0
Oak Timber	per cub. ft.	0	1	6		0	2	6
Oak Planks	,,	0	1	6		0	2	1
East India Teak	per load	12	0	0		15	0	0
Greenheart	,,	6	15	0		7	10	0

EUROPEAN WOODS.

Timber.

		£	s.	d.		£	s.	d.
Riga Redwood	per cub. ft.	0	1	9	to	0	2	3
Dantzic and Memel Fir, Crown	,,	0	2	1		0	2	6
Dantzic and Memel Fir, Middling	,,	0	1	9		0	1	10
Stettin	,,	0	1	9		0	1	11
Swedish	,,	0	1	2		0	1	4
Riga Whitewood	,,	0	1	3		0	1	6
Norway Mining Timber	,,	0	0	9		0	0	10
Dantzic and Stettin, etc., Oak	,,	0	2	6		0	3	0

Wainscot Logs.

		£	s.	d.		£	s.	d.
Crown	,,	0	4	6		0	5	0
Austrian	,,	0	4	0		0	4	6
Norway Spars	,,	0	1	2		0	1	9

Deals.

		£	s.	d.		£	s.	d.
Red Archangel and Onega, 1st quality	per std.	19	0	0		20	0	0
Red Archangel and Onega, 2nd quality	,,	16	0	0		17	10	0
Red Archangel and Onega, 3rd quality	,,	12	10	0		15	0	0
St. Petersburg, 1st quality	,,	16	0	0		17	10	0
Do. 2nd ,,	,,	14	0	0		15	0	0
Gefle	,,	14	0	0		17	10	0
Wyburg	,,	12	10	0		14	0	0
Uleaborg	,,	12	10	0		14	10	0
Gothenburg	,,	14	0	0		17	10	0

Flooring Boards—Whitewood:

		£	s.	d.		£	s.	d.
Mixed 1st and 2nd quality, planed (c.f.&i.)	per std.	8	5	0		8	15	0
3rd quality planed (c.f.&i.)	,,	7	10	0		7	15	0

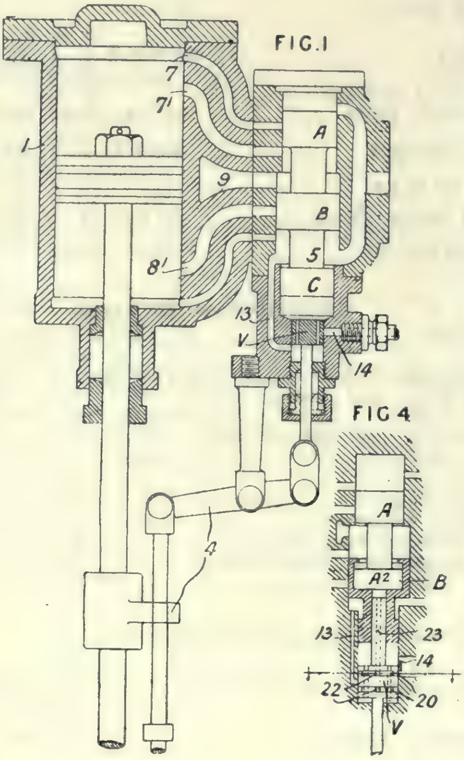
Lathwood:

		£	s.	d.		£	s.	d.
St. Petersburg and Riga—8 feet	per fm.	10	10	0		11	10	0
St. Petersburg and Riga—4 feet	,,	5	5	0		5	10	0

SELECTED PATENTS.

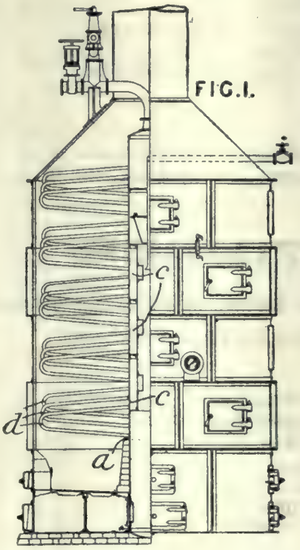
PUMPS.

C. R. Honiball. Liverpool. July 18th.—This invention relates to valve gear for fluid-operated direct-acting pumps and consists in providing a differential piston valve adapted to be operated by a small auxiliary valve, the arrangement being such that a comparatively small quantity of fluid, say, steam, is used to operate the main valve. Fig. 1 shows a sectional elevation of the valve gear as applied, in its simplest form, to a single-cylinder steam pump. In the figure, 1 denotes the steam cylinder, 4 the tappet motion, A, B the main valve, V the small auxiliary valve, 9 the exhaust port, and 7^1, 8^1, additional ports to give a partial cushioning. The valve V, which is operated by the tappet gear, controls the passage 13 and an exhaust port 14 and the arrangement is such that, when the valve V is in its highest position, the space below the piston B is in communication with the space below the plunger C, with the result that the main valve is forced upwards. When the valve V is in its lowest position, the space below C is connected to the exhaust 14, and the main valve is forced downwards. A modification is shown, in which, in place of the plunger C, the piston B is recessed and works over a fixed piston having a passage through it, which communicates with the chamber in which the valve V works. When the valve is required to control a two-cylinder compound pump, an additional piston of the same diameter as A is formed on the stem 5. In order to allow for expansive working, the valve is made in the form shown in fig. 4, the piston A being able to move a definite distance relative to piston B. The valve V is also modified so as to have two peripheral recesses 20, which communicate through holes 22 and a passage 23 with the space below piston A^2. The effect of the first movement of the valve V is to partially cut off the steam supply; at the end of the working stroke, the steam supply is completely cut off, and the exhaust connection made. The working of the pump may be regulated in any of the above arrangements by the action of a float in the boiler or tank into which the water is pumped, the float actuating a small cock, which controls the exhaust 14 or passage 13.



STEAM GENERATORS.

E. H. Q. Henriques, H. T. Wright and Sir Hiram Maxim Electrical and Engineering Company, London. July 15th.—This invention is concerned with radial water-tube boilers.—Upon the shell of the central vertical chamber *a*, a series of annular spaces *c* are formed. The ends of the water tubes *d*



open to these spaces in succession, the upper ends of one set being connected to the chamber into which the lower ends of the next superposed set open. The uppermost tube form superheaters. To prevent priming, two perforated plates are provided in the steam space in conjunction with a deflector.

STEAM ENGINES.

C. L. Fouts, California, U.S.A. July 14th.—The engine comprises two single-acting cylinders 15 with trunk pistons, which uncover exhaust ports 29, at the end of the outstroke, and, towards the end of the instroke, close at valve 32, by which the residual exhaust escapes. The valves 32 for the two cylinders are connected together so that, by closing one, the other is opened. The admission valves 21, fig. 1, are opened by adjustable screws 22^1 in the pistons, and the expansion is adjusted to suit different kinds of work by varying the clearance by means of packing-discs 25. But the admission valve may be worked, as shown in fig. 4, by a sliding cam 66 under the control of the governor. Fig. 6 shows an enlargement of the cam; it is mounted to slide in a slot in the countershaft, through which the governor spindle 54 passes. The governor comprises weighted levers 52 pivoted to arms 50 on the disc 47 and gearing with pinions on the levers 55, which engage the spindle 54. An adjustable spring at the end of the spindle varies the load.

FIG. 1.

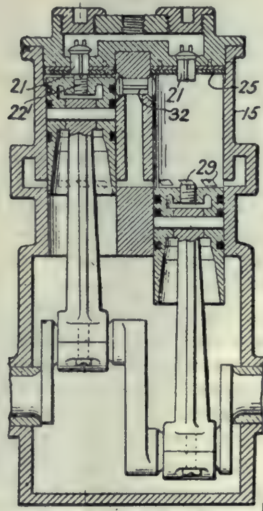


FIG 4

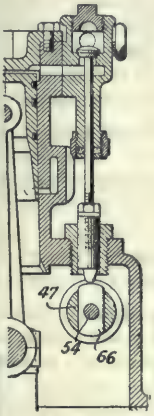


FIG. 6.

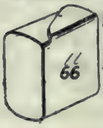
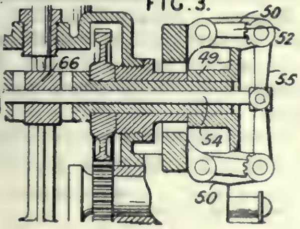


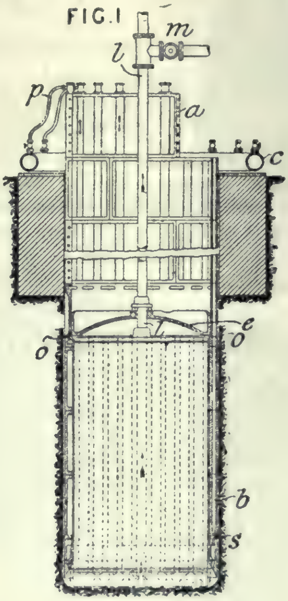
FIG. 3.



DEEP BORING.

E. Frieh and R. Nollenburg, Nordhausen, Prussia. July 14th.—In sinking shafts through loose or wet ground by a water-flush system of boring, the flushing-water is forced down to the shoe through channels or pipes *b*, formed in, or attached to, the tubbing *a*, and it returns up the hollow boring-rods *l*, carrying the spoil. The rods *l* pass through a gland on the diaphragm *e*, which rests on an internal flange *o* on the lower portion of the tubbing, and carries the boring-tools. The passages *b* are connected by flexible hose *p* to the water-supply main *c*, so that they can be disconnected for the addition of additional rings of tubbing, segment by segment. Non-return valves *s* may be placed in the passages *b*. A valve *m* is placed in the hollow rods above the shaft to cause the water to flow outside the tubbing.

FIG. I



From the "Illustrated Official Journal" (Patents).

NEW PUBLICATIONS.

"SMALL DESTRUCTORS FOR INSTITUTIONAL AND TRADE WASTE."

By W. Francis Goodrich. With twenty-eight illustrations. Constable and Co. 4s. net.

Although a matter of great importance to the sanitary engineer, the erection of incinerators for the destruction of institutional refuse has hitherto been a subject somewhat neglected; the author tells us that on this account he undertook the preparation of the above work in the hope that it would be helpful to those responsible for the planning and superintendence of public institutions or large works, where the available waste may frequently be turned to profitable account for power production. The writer claims that, so far as hospital requirements are concerned, the modern institutional refuse destructor must be a small replica of the larger municipal refuse destructor, and the vital principle of the latter, viz., high temperature working, must be the vital principle of the former. The work, which is illustrated with photographs and detailed sectional drawings, evinces signs of sound technical knowledge and practical experience, and is one we can recommend to all interested in this particular field of engineering.

"MODERN ELECTRIC PRACTICE."

Edited by Magnus Maclean, M.A., D.Sc. Volume IV. Gresham Publishing Company. 9s.

The high standard of the three preceding volumes, with which we have already dealt, is well maintained in the present volume, which discusses overhead construction, tramway feeders, surface-contact systems, conduit systems of electric traction, rolling-stock, and equipments, electric boats and motor-cars, concluding with electric traction on railways.

BOOKS RECEIVED.

Elementary Manual of Applied Mechanics. By Andrew Jamieson, M.Inst.C.E. Sixth edition. Revised and enlarged. Griffin and Co. 3s. 6d.

Central Electrical Stations, their Design, Organisation, and Management. By Charles Henry Wordingham, A.K.C. Second edition. Illustrated. Griffin and Co. 24s. net.

The Electric Furnace. By Henri Moissan. Translated by A. T. de Mouilpied. Arnold. 10s. 6d.

We have also received the undermentioned Transactions, etc.:—

Journal of the Institution of Electrical Engineers, including original communications on Telegraphy and Electrical Science. Published under the supervision of the Editing Committee, and Edited by George C. Lloyd, secretary. E. and F. N. Spon. 4s.

Institution of Electrical Engineers. List of Officers and Members.

Institution of Mechanical Engineers. Proceedings, February–April, 1904. Published by the Institution.

Progress of Warship Engineering in 1903–04. By Charles DeGrave Sells, M.Inst.C.E. Reprinted from All the World's Fighting Ships. Sampson Low and Co.

NEW CATALOGUES.

From the **New Anglo-American Machine Brush Syndicate,** of 31, Wool Exchange, London, E.C., we have received a special abridged catalogue and price-list of Brass and Iron Foundry Steel Wire Brushes, etc., for engineers, brass and iron founders, etc.

John Stirk and Sons, Ovenden Road, Halifax.—A good effect has been obtained in this catalogue of engineers' tools by confining the illustrations to left-hand pages and by printing the descriptions in short terse sentences in widely spaced type on the opposite pages. The catalogue is also well bound and makes a handy volume for shelf reference.

Ernest Gunnill and Co., St. Andrew's Works, Goole.—From this firm we have received a leaflet descriptive of their patent hatch batten grip. This is made throughout of specially annealed steel, and one sharp blow to fasten or release it.

Cunliffe and Groom, Ltd., Broughton Iron Works, Manchester. The latest production of this firm is a four-page supplementary list to catalogue devoted to tools for brass finishers, the back page being devoted to their disc grinder—a machine designed for finishing, by grinding, flat surfaces on all metals, and especially adapted for brass finishing,

Library Bureau, Ltd.—A folding pamphlet with a somewhat novel cover showing the new premises of the company, draws attention to the fact that, owing to increased business, spacious additional premises have been secured at 22, Cross Street, Islington, N., where in future all counting-house business will be transacted. The establishment at 10, Bloomsbury Street, W.C., will be continued as a London salesroom.

Geo. G. Blackwell, Sons, and Co., Ltd., Liverpool.—From this firm we have received a small booklet, setting forth the advantages of the S.A.M. alloy, as used by iron and steel makers for the production of sound ingots and castings.

MEETINGS FOR THE ENSUING WEEK.

SATURDAY, Nov. 19.—The Lord Mayor opens the International Gas Exhibition at Earl's Court.

MONDAY, Nov. 21.—Royal Geographical Society: Dr. Hunter Workman on "Explorations in the Western Himalayas," 8.30.—Institution of Marine Engineers; Meeting at Romford Road, Stratford, 8 p.m.

TUESDAY, Nov. 22.—Royal United Service Institution: Paper by Colonel G. E. Gourand, 3 p.m.—University of Liverpool Engineering Society: Meeting in the Engineering Lecture Hall, "Miscllaneous Papers," 5.30 p.m.—Society of Motor Manufacturers; Dinner at Hotel Cecil, 7.30.—Royal Colonial Institute: Paper by Mr. W. Staley Spark on "The Wealth of Canada as an Agricultural Country," Whitehall Rooms, 4.30. p.m.—Institution of Civil Engineers meet at 8 p.m.

WEDNESDAY, NOV. 23.—Society of Arts: Ordinary Meeting, John Street, Adelphi; Paper by Mr. B. H. Morgan, on "The Systematic Promotion of British Trade."—Geological Society of London; Meeting at Burlington House, 8 p.m.

THURSDAY, NOV. 24.—Institution of Electrical Engineers meet at Great George Street, Westminster, 8 p.m.—The Royal Society meets at 4.30 p.m.—Royal United Service Institution; Paper by Lieutenant-Colonel C. B. Mayne, 3 p.m.

FRIDAY, NOV. 25.—Physical Society of London: Meeting at the Finsbury Technical College, 5 p.m.

SATURDAY, NOV. 26.—Glasgow Technical College Scientific Society: Paper by Mr. Maurice Georgi on "The Electrical Drive of Large Reversing Engines."

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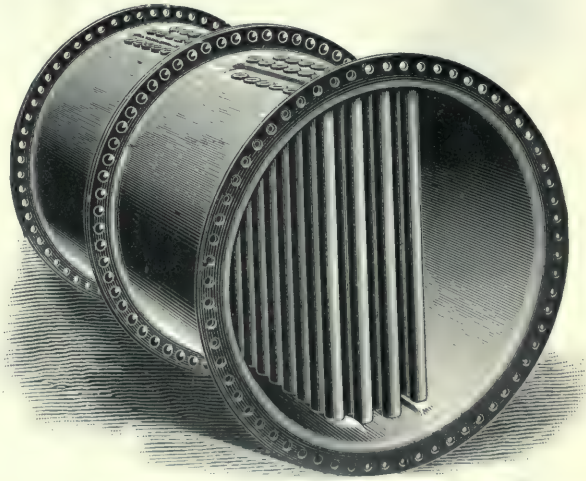

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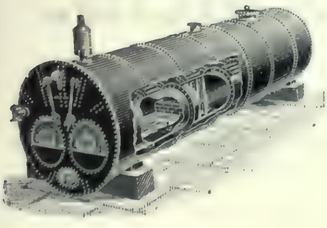

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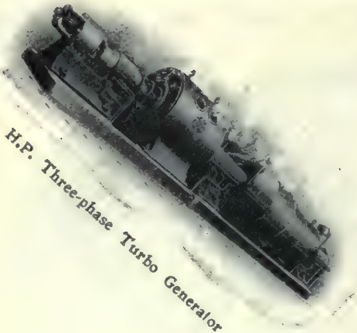

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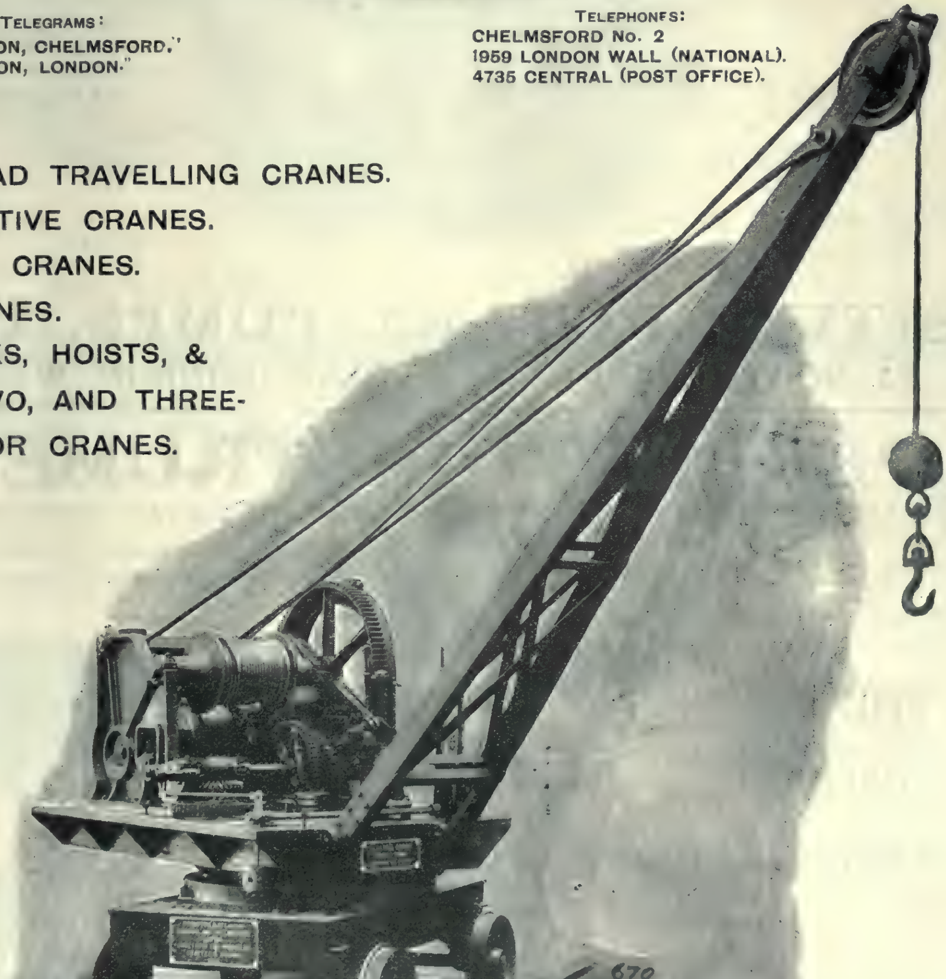

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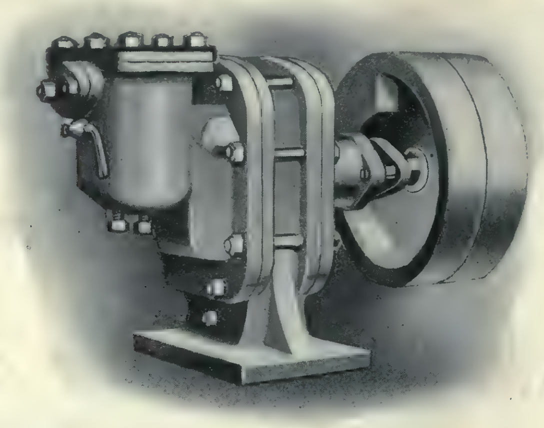

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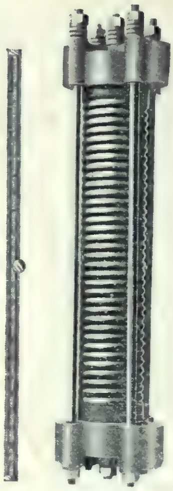

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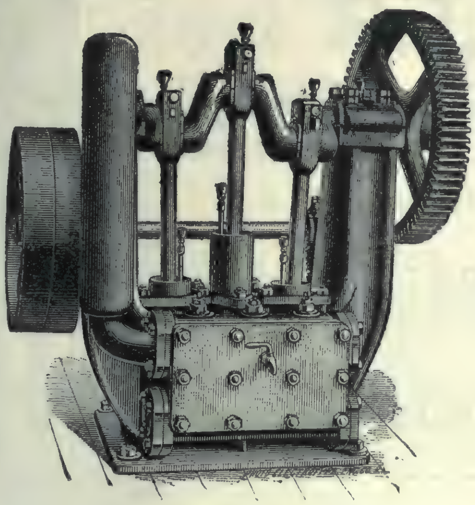

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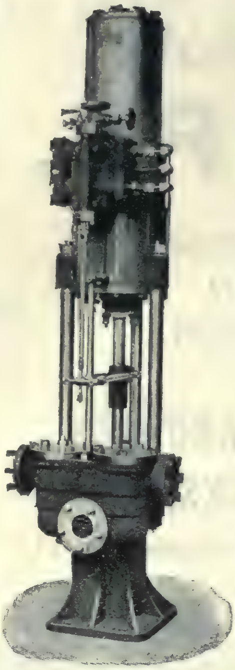

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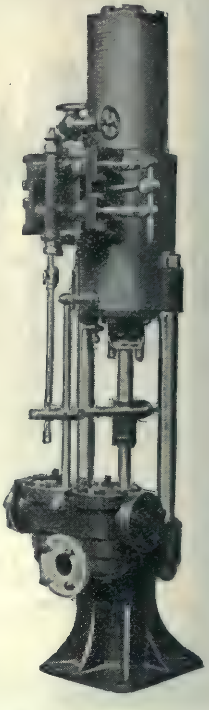

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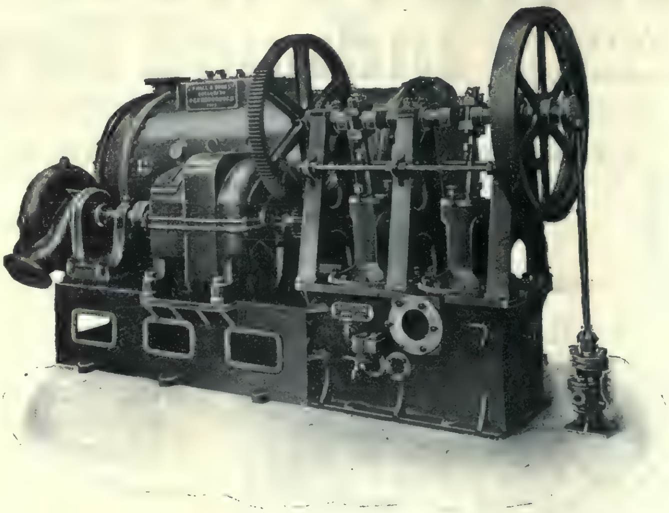

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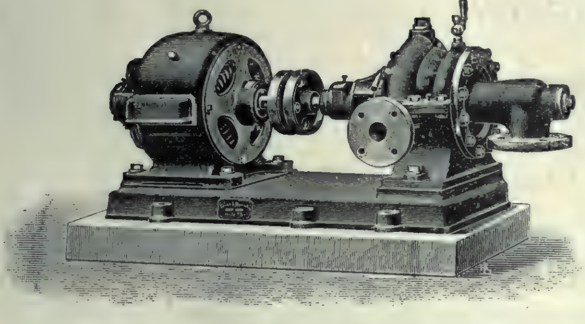

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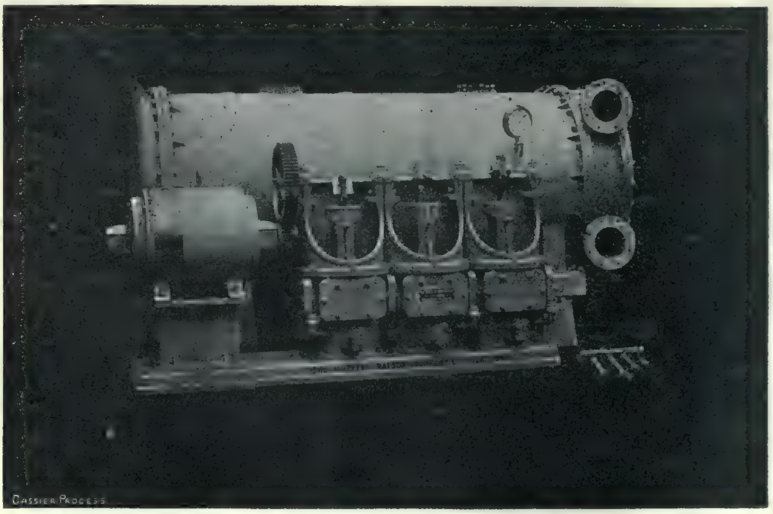

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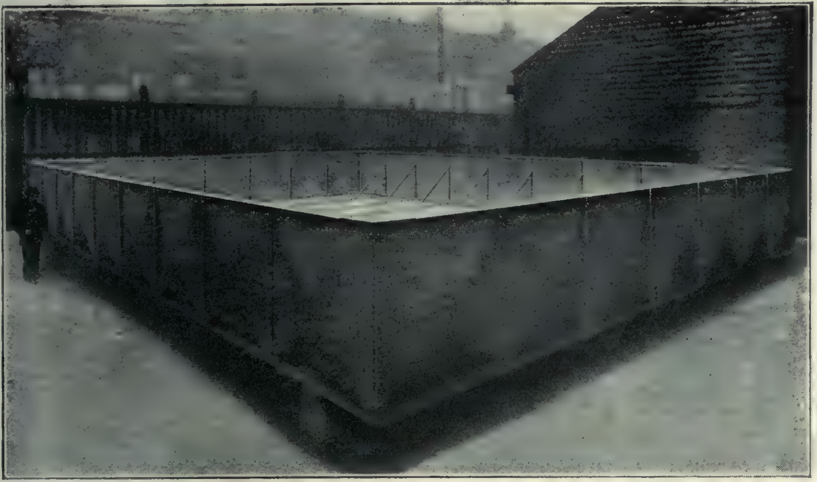

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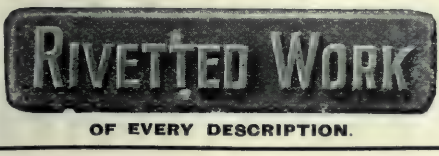

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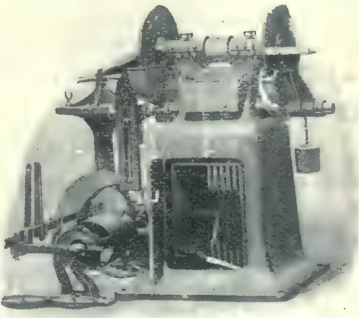

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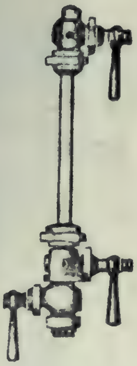

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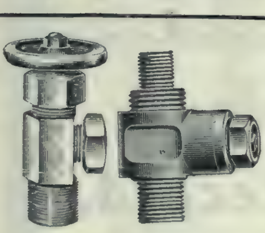

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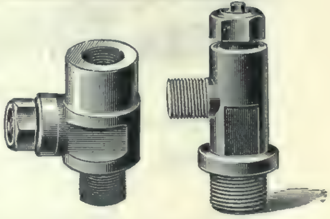

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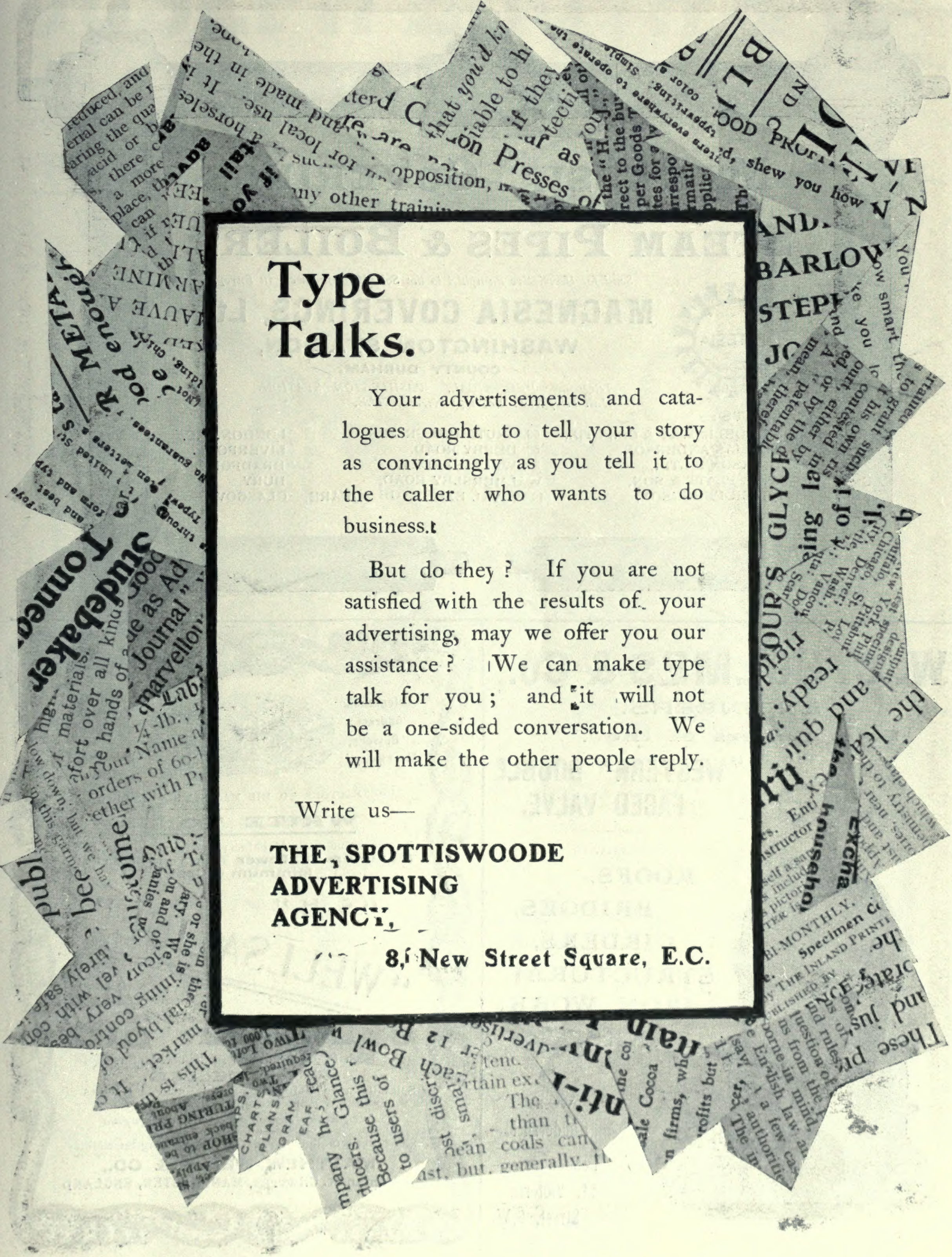

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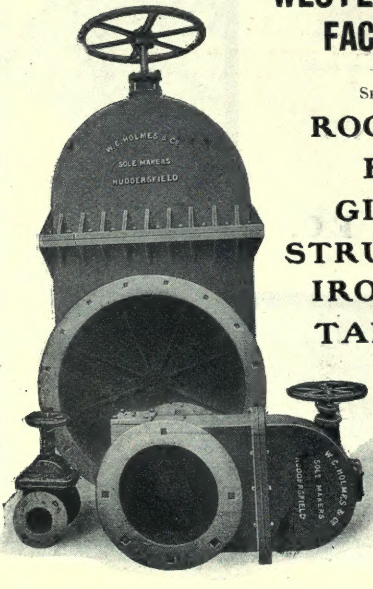

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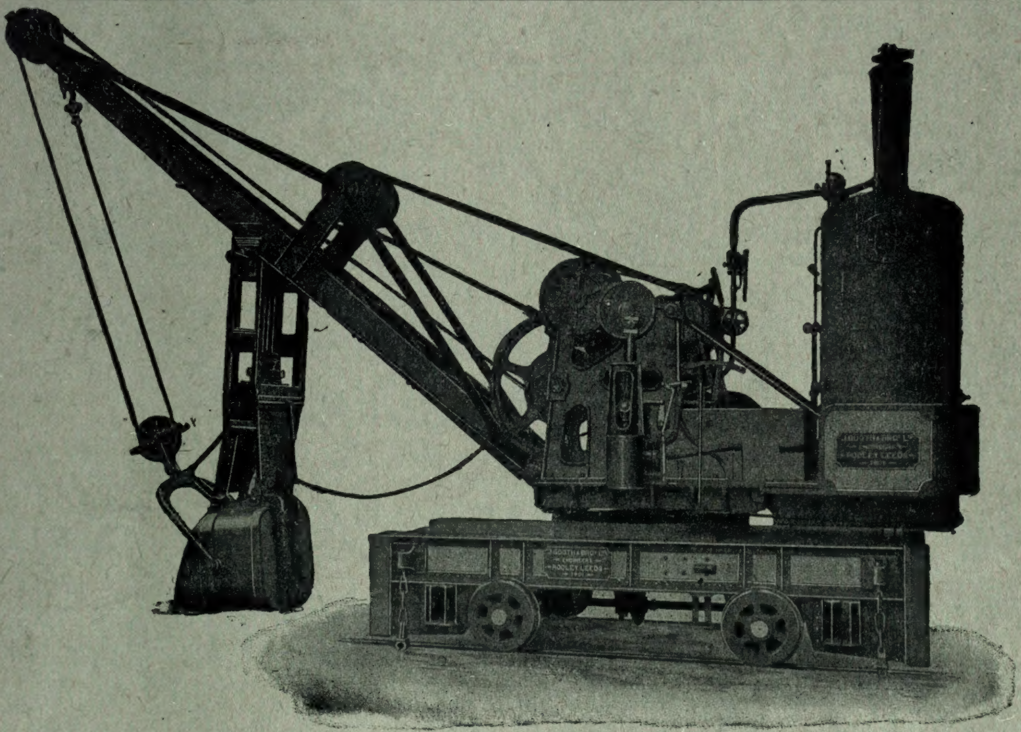

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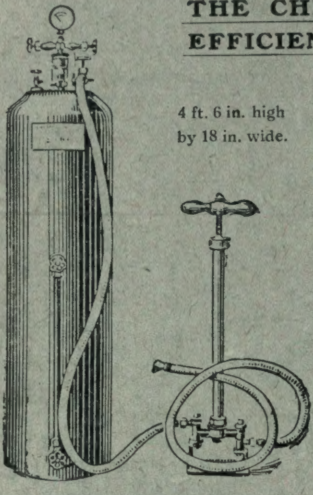

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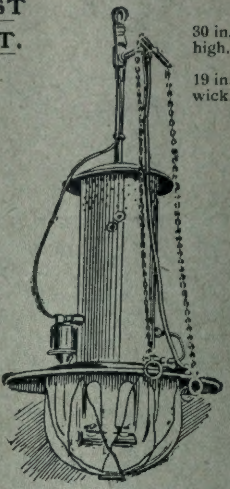

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